

SELECTED



**WATER**

**RESOURCES**

**ABSTRACTS**



**VOLUME 7, NUMBER 1**  
**JANUARY 1, 1974**

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# **SELECTED WATER RESOURCES ABSTRACTS**

**A Semimonthly Publication of the Water Resources Scientific Information Center,  
Office of Water Resources Research, U.S. Department of the Interior**



**VOLUME 7, NUMBER 1  
JANUARY 1, 1974**

W74-00001 -- W74-00550

The Secretary of the U. S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

## FOREWORD

**Selected Water Resources Abstracts**, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

**Selected Water Resources Abstracts** is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by co-ordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center  
Office of Water Resources Research  
U.S. Department of the Interior  
Washington, D. C. 20240

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# SELECTED WATER RESOURCES ABSTRACTS

## 01. NATURE OF WATER

### 1B. Aqueous Solutions and Suspensions

**SIGMA-INDUCTIVE MODEL VS. FIELD MODEL. OBSERVATION OF A REVERSED ATTENUATION EFFECT.**  
Georgia Inst. of Tech., Atlanta. School of Chemistry.  
For primary bibliographic entry see Field 02K.  
W74-00323

**MECHANISM OF TRANSMISSION OF NON-COJUGATIVE SUBSTITUENT EFFECTS. IV. ANALYSIS OF THE DISSOCIATION CONSTANTS OF 6-SUBSTITUTED SPIRO (3,3) HEP-TANE-2-CARBOXYLIC ACIDS,**  
Georgia Inst. of Tech., Atlanta. School of Chemistry.  
For primary bibliographic entry see Field 02K.  
W74-00324

## 02. WATER CYCLE

### 2A. General

**METHODOLOGY FOR ASSESSING THE POTENTIAL IMPACT OF URBAN DEVELOPMENT ON URBAN RUNOFF AND THE RELATIVE EFFICIENCY OF RUNOFF CONTROL ALTERNATIVES,**  
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.  
G. Leclerc, and J. C. Schaake.  
Available from the National Technical Information Service as PB-224 477, \$6.25 in paper copy, \$1.45 in microfiche. Report 167, 1973. 257 p., 66 fig., 28 tab., 40 ref., 4 append. OWRR C-2137 (No 3403) (5). 14-31-0001-3403.

Descriptors: \*Urban runoff, \*Storm runoff, \*Rainfall-runoff relationships, \*Urbanization, \*Detention reservoirs, \*Mathematical models, \*Statistical models, Urban hydrology, Surface runoff, Precipitation, Storm drains, Urban drainage, Model studies.

A methodology was developed to assess the potential impact of urban development on urban runoff and to measure the relative efficiency of runoff control alternatives. The methodology utilizes runoff frequency curves, derived at different stages of development of the urban catchment. Comparisons of these curves completely quantify the impact of urban development and/or the efficiency of a control structure. Runoff frequency curves are derived directly from the rainfall process. The method of solution utilizes a stochastic model of the rainfall process and a deterministic model of the catchment. The rainfall model describes the rainfall exterior and the rainfall interior and preserves the Intensity-Duration-Frequency curves of the historical rainfall sample. The catchment model developed with the kinematic wave equations is a modular model; detailed and simplified configurations of the prototype catchment have been successfully developed. Filter theory is used to estimate the parameters of the infiltration model from observations of the rainfall and of the runoff. The method of solution, referred to as stochastic/deterministic simulation, incorporates the stochastic rainfall model, the deterministic catchment model, and the results of the infiltration estimator. Results show that the solution procedure and the methodology developed are recommended for urban drainage analysis.  
W74-00001

**INTERACTION OF BULK PRECIPITATION, STREAM WATER, AND SEWAGE IN A SMALL WATERSHED NEAR OXFORD, MISSISSIPPI,**  
Mississippi Univ., University. Dept. of Geology and Geological Engineering.

K. J. Banaszak, C. B. Whitten, and D. A. Thompson.

Available from the National Technical Information Service as PB-224 434, \$3.75 in paper copy, \$1.45 in microfiche. Mississippi State University, Mississippi. State Water Resources Research Institute Report, August 1973. 70 p., 21 fig., 11 tab., 155 ref. OWRR A-063-MISS (1).

Descriptors: Weathering, Chemical reactions, Heavy metals, Soils, \*Mississippi, \*Small watersheds, \*Precipitation (Atmospheric), \*Sewage, \*Streamflow, Discharge (Water), Storm runoff, Chemical analysis.

Identifiers: \*Oxford (Miss), \*Urban watersheds.

A 500 hectare (54% forest, 26% pasture and fallow field, and 20% rural urban) rainfed watershed near Oxford, Mississippi was studied from July 1, 1972 to June 30, 1973. During this period, 200 centimeters (132 cm are 'normal') of precipitation with an average pH of 4.6 and an average composition in parts per million of 0.66 calcium, 0.04 magnesium, 0.34 sodium, and 0.23 potassium fell. The stream discharge of 80 centimeters had a neutral pH and an average composition in parts per million of 6.4 calcium, 1.5 magnesium, 6.4 sodium, 2.2 potassium, 13 bicarbonate, 12 sulfate, and 5.5 chloride. A sewage influx of 50 liters per second had little noticeable effect on the composition of storm runoff. The reasons for the change from bulk precipitation to stream water are not clear but must involve biologic, aerosol, and anthropogenic material. The change is compatible with a change from a water in equilibrium with gibbsite to a water in equilibrium with gibbsite and kaolinite. The net output for the study year from the watershed in kilograms per hectare-year was 43 for calcium, 12 for magnesium, 44 for sodium, 14 for potassium, and 36 for silica. These outputs are not compatible with earlier studies but are compatible with gross chemical erosion rates. Data for cadmium and zinc were inconclusive.  
W74-00005

**DEVELOPING A COOPERATIVE RESEARCH PROGRAM FOR FLOOD CONTROL IN BRAHMAPUTRA VALLEY,**  
Brahmaputra Flood Control Commission (India).  
For primary bibliographic entry see Field 10A.  
W74-00195

**DIGITAL MODEL OF THE HYDROLOGIC SYSTEM, NORTHERN HIGH PLAINS OF COLORADO-A PRELIMINARY REPORT,**  
Geological Survey, Denver, Colo.  
For primary bibliographic entry see Field 02F.  
W74-00330

**WATER IN THE SAN LUIS VALLEY, SOUTH-CENTRAL COLORADO,**  
Geological Survey, Denver, Colo.  
P. A. Emery, R. J. Snipes, J. M. Dumeyer, and J. M. Klein.  
Colorado Water Resources Circular No 18, 1973. 26 p., 7 fig., 10 plate, 2 tab., 14 ref.

Descriptors: \*Water resources, \*Surface waters, \*Groundwater resources, \*Hydrologic data, \*Colorado, Water quality, Mountains, Snowmelt, Streams, Aquifer characteristics, Hydrogeology, Valleys, Water wells, Water utilization, Irrigation, Domestic water, Livestock, Confined water, Water yield, Groundwater recharge, Chemical analysis, Hydrologic budget, Deserts.  
Identifiers: \*San Luis Valley (Colo).

The San Luis Valley of south-central Colorado is a high mountain desert with an area of approximate-

ly 3,200 square miles. It has an average altitude of about 7,700 feet, and the annual precipitation averages about 7.5 inches. The primary source of water to the valley is surface-water inflow derived chiefly from snowmelt. About 86% of the water supplied to the valley by surface-water inflow and precipitation is consumed by evapotranspiration. Irrigation has increased during the last two decades, mainly due to substantially increased withdrawal of groundwater. More than 1,800 large-capacity irrigation wells withdraw water from the unconfined aquifer. Water is withdrawn from the confined aquifer by more than 650 large-capacity irrigation wells and about 7,000 small-capacity domestic, stock, and pasture-irrigation wells. The chemical quality of water in the unconfined aquifer is excellent around the rim of the valley. In the central part of the valley water in the confined aquifer has a brownish color and contains gas. This colored water is commonly associated with high fluoride concentration and high salinity and alkali hazard. The chemical quality of surface water is generally excellent; the dissolved solids concentration ranged from 25 to 450 mg/liter in 28 of the 32 streams sampled. (Woodard-USGS)  
W74-00331

**INFILTRATION PROPERTIES OF SOILS AND INTRAZONAL STRUCTURE OF THE HYDROLOGIC BUDGET (INFILTRATSIONNYE SVOYSTVA POCHV I VNUTRIZONAL'NYYE OSOBOENNOSTI STRUKTURY VODNOGO BALansa),**

For primary bibliographic entry see Field 02G.  
W74-00341

**RECONSTRUCTION OF THE WATER BALANCE OF LAKE BALKHASH (REKONSTRUKTSIYA VODNOGO BALansa OZ. BALKHASH),**  
For primary bibliographic entry see Field 02H.  
W74-00344

**ESTIMATING THE PRECIPITATION CLIMATE,**  
Scripps Institution of Oceanography, La Jolla, Calif.  
C. K. Stidd.  
Water Resources Research, Vol 9, No 5, p 1235-1241, October 1973. 4 fig., 1 tab., 10 ref.

Descriptors: \*Flood forecasting, \*Estimating, \*Droughts, \*Precipitation (Atmospheric), Statistics, Rainfall-runoff relationships, Flood frequency, Statistical methods, Monte Carlo method, Data collection.

Climatic expectancies of flood or drought may be estimated from the mean and variance of a precipitation record. An interrelationship between the distributions of measurements from various observing periods allows any one of these records to be used to estimate the others. The method is based on the cube root normal distribution of precipitation and on an observed tendency for the distribution lines to be parallel. Graphs and tables are provided as an aid to making these estimates. The relationship between monthly, daily, and other measurements must be derived from the frequency spectrum of precipitation rates. This spectrum has the same profile as the theoretical spectrum for atmospheric pressure; thus the spectrum of kinematic energy regulates the relationship between precipitation distributions. (Knapp-USGS)  
W74-00375

**LOSS OF PARTICULATE ORGANIC MATERIALS FROM SEMIARID WATERSHEDS AS A RESULT OF EXTREME HYDROLOGIC EVENTS,**  
Utah State Univ., Logan. Watershed Science Unit. G. F. Gifford, and F. E. Busby.

## Field 02—WATER CYCLE

### Group 2A—General

Water Resources Research, Vol 9, No 5, p 1443-1449, October 1973. 5 fig, 1 tab, 9 ref.

Descriptors: \*Rainfall-runoff relationships, \*Runoff, \*Overland flow, \*Nutrient removal, Floods, Organic matter, Nutrients, Deserts, \*Utah.

Three debris basins in southern Utah were sampled to determine the amount of particulate organic debris deposited as a result of a single extreme runoff event on each of the three semiarid watersheds above the basins. The total quantity of large particulate organic materials lost from each contributing area ranged from 64.06 kg/ha to 12.89 kg/ha. Vegetation on the watersheds was primarily big sagebrush, pinyon, and Utah juniper. Nutrient losses due to the removal of particulate organic materials from each watershed were also approximated. (Knapp-USGS)  
W74-00378

### 2B. Precipitation

#### AN ELECTRONIC SENSOR AND CIRCUIT FOR AUTOMATIC OPERATION OF RAINFALL SHELTERS,

Mississippi State Univ., State College. Dept. of Agronomy.

For primary bibliographic entry see Field 07B.

W74-00042

#### ESTIMATING THE PRECIPITATION CLIMATE,

Scripps Institution of Oceanography, La Jolla, Calif.

For primary bibliographic entry see Field 02A.

W74-00375

#### TROPICAL CYCLONE PRECIPITATION IN NEW JERSEY,

Rutgers-The State Univ., New Brunswick, N.J. Dept. of Meteorology.

E. A. Brovak, and M. D. Shulman.

New Jersey Academy of Science 'Bulletin', Vol 16, No 1-2, p 2-7 Spring-Fall, 1971. 5 fig, 6 tab, 16 ref.

Descriptors: \*Tropical cyclones, Hurricanes, \*New Jersey, Climatology, \*Precipitation (Atmospheric), Storms, Seasonal.

Identifiers: \*Cyclone precipitation.

All tropical cyclones producing measurable precipitation in New Jersey for the period 1930-1969 were analyzed to determine their origin, intensity, movement, and precipitation amounts. There were 46 such storms with most occurrences in August and September. Percentages of total monthly and annual precipitation are given for 21 selected stations scattered throughout the state. Annual percentages of precipitation caused by tropical cyclones range from 5 or 6% in the south to 3 or 4% in the north. Monthly percentages up to 40% were recorded in the southeastern part of the state for September.

W74-00435

#### VARIATION OF THE LOW LEVEL WINDS DURING THE PASSAGE OF A THUNDERSTORM GUST FRONT,

Pennsylvania State Univ., University Park.

R. W. Sinclair, R. A. Antes, and H. A. Panofsky. Available from NTIS, Springfield, Va. 22151 NASA CR-2289 Price \$3.00 printed copy; \$1.45 microfiche. National Aeronautics and Space Administration Contractor Report NASA CR-2289, July 1973. 65 p, 29 fig, 3 tab, 15 ref. NASA Contract NAS8-27334.

Descriptors: \*Thunderstorms, \*Wind velocity, \*Aircraft, Shear strength, Statistical analysis, Meteorological data, \*Florida, \*Oklahoma, Altitude, Winds, Variability, Forecasting, Regression analysis, Atmospheric physics.

One atmospheric phenomenon that may adversely affect the operation of aeronautical systems is the cold surge or gust front accompanying thunderstorms. Three time histories of wind profiles in thunderstorm gust fronts at Cape Kennedy and three at Oklahoma City are analyzed. Wind profiles at maximum wind strength below 100 m follow logarithmic laws, so that winds above the surface layer can be estimated from surface winds once the roughness lengths is known. A statistical analysis of 81 cases of surface winds during thunderstorms at Tampa revealed no predictor with skill to predict the time of maximum gust. Some 34% of the variance of the strength of the gust is accounted for by a stability index and surface wind prior to the gust; the regression equations for these variables are given. The coherence between microscale wind-speed variations at the different levels has the same proportions as in nonthunderstorm cases. (Woodard-USGS)  
W74-00545

### 2C. Snow, Ice, and Frost

#### NUTRIENT FACTORS LIMITING PRIMARY PRODUCTIVITY IN SIMULATED AND FIELD ANTARCTIC MICROECOSYSTEMS,

Virginia Commonwealth Univ., Richmond. Dept. of Biology.

For primary bibliographic entry see Field 05C.

W74-00069

#### THE GROWTH OF PINGOS, WESTERN ARCTIC COAST, CANADA,

British Columbia Univ., Vancouver. Dept. of Geography.

J. R. Mackay.

Canadian Journal of Earth Sciences, Vol 10, No 6, p 979-1004, June 1973, 24 fig, 4 tab, 57 ref.

Descriptors: \*Permafrost, \*Canada, \*Arctic, Freezing, Frost, Frost heaving, Silts, Lakes, Lake beds, Soil mechanics.

Identifiers: \*Pingos.

The growth rates of 11 closed system pingos were measured by precise levelling of permanent bench marks anchored well down into permafrost. The rate of growth of the pingo decreases from the summit to the base, and the rate of the growth of the ice-core decreases from the center out to the periphery. The pingos grow in the bottoms of lakes which have drained rapidly and thus become exposed to permafrost aggradation. The specific site of growth is usually in a small residual pond where permafrost aggradation is retarded. The size and shape of a residual pond exercises a strong control upon the size and shape of the pingo which grows within it. The icecore thickness equals the sum of the pingo height above the lake flat and the depth of the residual pond in which the pingo grew. Pingos tend to grow higher rather than both higher and wider. Pingos are believed to grow more by means of ice segregation than by the freezing of a pool of water. The water source, and the associated positive pore water pressure, result from permafrost aggradation insands and silts in the lake bottom under a closed system with expulsion of pore water. The fastest growth rate of an icecore for the Western Arctic Coast is estimated at about 1.5 m/yr for the first 1 or 2 years. After that, the growth rate decreases inversely as the square root of time. The largest pingos may continue to grow for more than 1,000 years. At least five pingos have commenced growth since 1935. Probably 50 or more pingos are now growing along the coast. (Knapp-USGS)  
W74-00098

#### RESULTS OF AN OPERATIONAL TEST OF M-100 RADIO-ELECTRONIC SNOW GAGES,

Gosudarstvennyi Gidrologicheskii Institut, Lenin-grad (USSR).

Z. A. Mikhaylova, and V. I. Ponomarev.

Soviet Hydrology: Selected Papers, No 4, p 320-324, 1971. 2 fig, 2 tab, 1 ref. Translated from Transactions of State Hydrologic Institut (Trudy GGI), No 189, p 83-88, 1971.

Descriptors: \*Precipitation gages, \*Testing, \*Testing procedures, \*Snow, \*Snow surveys, Water equivalent, Radiation, Gamma rays, Winter, Equations.

Identifiers: USSR, Snow courses.

Operational tests were performed on 19 M-100 radio-electronic snow gages in the winter of 1968-69 to determine their basic operational characteristics and possible use as a replacement for the weighing-type snow gage. Upon elimination of constructional inadequacies and with proper operational conditions, the M-100 snow gage can be used in the Hydrometeorological Service network for snow surveys in regions with continuous snow cover. (Josefson-USGS)  
W74-00109

#### EFFECT OF AN ERROR IN THE DETERMINATION OF THE MAXIMUM WATER EQUIVALENT OF SNOW IN A BASIN ON THE FORECAST ACCURACY OF THE SPRING FLOOD VOLUME,

Gosudarstvennyi Gidrologicheskii Institut, Lenin-grad (USSR).

R. A. Nezhikhovskiy.

Soviet Hydrology: Selected Papers, No 4, p 324-327, 1971. 2 tab, 6 ref. Translated from Transactions of State Hydrologic Institute (Trudy GGI), No 193, p 62-66, 1971.

Descriptors: \*Water equivalent, \*Snowpacks, \*Watersheds (Basins), \*Flood forecasting, Flood discharge, Spring, Snow surveys, Correlation analysis, Equations.

Identifiers: USSR.

The acceptable accuracy with which average maximum water equivalent of snow in a basin can be determined and the effect which an error in determination of maximum water equivalent has on closeness of stochastic relations used in spring-flood forecasting are examined. With considerable variability in maximum water equivalent and flood runoff, the accuracy with which water equivalent is determined has relatively little effect on the closeness of predictive relations. An increase in the accuracy of determination of maximum water equivalent in a basin is a prerequisite for improving quality of spring runoff forecasts in northern regions. For rivers in southern regions, additional factors must be considered, including permeability of soils before start of snowmelt. (Josefson-USGS)  
W74-00110

#### SHORT-TERM SNOW LOADS,

V. I. Lipovskaya.

Soviet Hydrology: Selected Papers, No 4, p 337-341, 1971. 2 fig, 3 tab, 9 ref. Translated from Transactions of the Voevodev Main Geophysical Observatory (Trudy GGO), No 283, p 35-42, 1971.

Descriptors: \*Snow, \*Snowpacks, \*Snow cover, \*Loads (Forces), Weight, Density, Depth, Snowfall, Storms, Winds, Probability, Curves, Equations.

Identifiers: USSR.

Loads created by snow accumulation must be computed for short periods of time as well as for an entire winter. To estimate magnitude of short-term heavy loads, the weight of snowpack produced by great snowfalls must be considered. A snow density of 0.14 g/cu cm was assumed for the Volga Region, the southern Urals, southern West Siberia, Kazakhstan, Sakhalin, and coastal areas of the Arctic Ocean, while a value of 0.11 g/cu cm was used for all other regions. Maximum daily snow loads ranging from 15 to 115 kg/sq m

## WATER CYCLE—Field 02

### Snow, Ice, and Frost—Group 2C

for 55 stations in European and Asiatic Russia and probability values of daily snow loads for 21 stations in the country are tabulated. (Josefson-USGS)  
W74-00111

#### DESCRIPTION OF SNOW TRANSPORT AND SNOW DEPOSITION IN THE EUROPEAN USSR,

V. M. Mikhel', and A. V. Rudneva.

Soviet Hydrology: Selected Papers, No 4, p 342-348, 1971. 2 fig, 2 tab, 11 ref. Translated from Transactions of Main Geophysical Observatory (Tudy GGO), No 283, p 87-96, 1971.

Descriptors: Snow, \*Snow cover, \*Snow surveys, Winds, Winter, Probability, \*Maps.

Identifiers: \*European USSR, \*Snow transport, Drifting snow, Blowing snow.

Patterns of snow transport and accumulation in winter during periods of blowing and drifting snow were investigated for the European part of the USSR. The volumes of snow transported and deposited over the territory vary widely and are mapped and tabulated with a probability of 5%. (Josefson-USGS)  
W74-00112

#### DETERMINATION OF THE DURATION OF NATURAL HYDROLOGIC PERIODS,

B. A. Krutskikh, and Yu. A. Gorbunov.

Soviet Hydrology: Selected Papers, No 4, p 348-354, 1971. 3 fig, 4 tab, 8 ref. Translated from Problems of the Arctic and Antarctic (Problemy Arktiki i Antarktiki), No 38, p 22-28, 1971.

Descriptors: \*Oceanography, \*Hydrology, \*Frequency, Time, Sea level, Water levels, Water level fluctuations, Variability, Water temperature, Salinity.  
Identifiers: USSR, \*East Siberian Sea, \*Chukchee Sea.

Hydrologic processes on a medium synoptic scale of 1 to 10 days are analyzed with allowance for their development and variations in time and space. An objective classification is made of space-time series of sea level, water temperature, and salinity to determine limits of unidirectional variations in elements of a sea's hydrologic regime, and a spectral analysis is made of initial data to determine duration of natural hydrologic periods more reliably. Based on investigations conducted at six polar stations in the East Siberian and Chuckchee Seas in July-October 1958-68, recurrence of low frequencies in water temperature and salinity variations is higher than for sea level. Results of determinations of recurrence periods by different methods attest to reliability of the established duration of natural hydrologic periods and can serve as a basis for further studies of processes within the limits determined on the basis of an objective classification. (Josefson-USGS)  
W74-00113

#### DETERMINATION OF LIQUID RUNOFF FROM THE FIRN FIELD OF A GLACIER,

P. F. Shabanov, K. G. Makarevich, and Ye. N. Vilesov.

Soviet Hydrology: Selected Papers, No 4, p 363-370, 1971. 5 fig, 7 ref. Translated from Geophysical Bulletin (Geofizicheskiy Byulleten'), No 24, p 29-38, 1971.

Descriptors: \*Glaciers, \*Firn, \*Runoff, \*Snowmelt, \*Water equivalent, Melting, Ablation, Ice, Infiltration, Snow surveys, Mountains, Maps, Equations.

Identifiers: \*Zailiski Ala Tau (USSR), Glacier mass balance, Firn line Superimposed ice, Isolines.

Investigation of runoff from the accumulation area as well as from the tongue of mountain glaciers at middle latitudes is an important problem in modern glaciology. Investigations were conducted on the Central Tuyuksu Glacier in the Zailiski Ala Tau mountain range to obtain data on runoff from the firm basin. Surface layers of a glacier accumulation area are diagrammed, and maps of the accumulation area of the Central Tuyuksu Glacier show distribution of observation points; isolines of water equivalent of snow (mm) during maximum accumulation in winter and spring of 1966-67; isolines of water equivalent of residual snow (mm) at the end of the ablation period in 1967; and isolines of superimposed ice (mm of water depth). (Josefson-USGS)  
W74-00115

#### EFFECT OF SALINITY ON THE OPTICAL EXTINCTION OF SEA ICE AT 6328A,

Cold Regions Research and Engineering Lab., Hanover, N.H.

H. Davis, and R. H. Munis.

Research Report 308, July 1973. 14 p, 7 fig, 4 tab, 8 ref, append.

Descriptors: \*Sea ice, \*Heat balance, \*Optical properties, \*Light penetration, Correlation analysis, Salinity, Analytical techniques, Radiation, Wavelengths, Evaluation.

Identifiers: \*Laser, Monochromatic light, Angstrom.

The penetration of shortwave radiation into sea ice is very important in specifying its heat balance. It is therefore necessary to understand the penetration of radiation of different wavelengths through sea ice under varying conditions. An investigation was made to determine the relationship between the extinction coefficient and the salinity of sea ice. A HeNe laser was used to propagate a beam of red light, of wavelength 6328 Angstroms through a series of ice samples at -20 deg C. The optical extinction coefficients were calculated and plotted against the measured salinities. The results of the experiment indicated an exponential relationship between extinction coefficient and salinity. (Woodard-USGS)  
W74-00333

#### SOLUBLE PARTICULATES IN ICE FROM SITE 2, GREENLAND,

Nevada Univ., Desert Research Inst., Reno.

G. O. Linkletter.

Army Cold Regions Research and Engineering Laboratory Special Report 188, July 1973. 17 p, 3 fig, 5 tab, 31 ref, 2 append. NSF Grant 104.

Descriptors: \*Glaciology, \*Ice cover, \*Chemical properties, \*Polar regions, Physical properties, Sampling, Cores, Depth, Chemical analysis, Hydrologic cycle, Glaciers, Correlation analysis, Evaluation.

Identifiers: \*Greenland, Ice accumulation.

Several investigators have found seasonal layering in snow in northern Greenland, and Langway (1962, 1967) has shown that certain physical and chemical parameters retain their cyclic behavior to at least 100 m depth. Collections of soluble and insoluble particles made by sublimation techniques from small pieces of polar ice are well suited for microscopic and microchemical analysis. Examination of an 89-cm vertical profile of a polar ice core from a depth of 100 m at Site 2, Greenland, indicated no seasonal cycle in the abundance of particles greater than 2 micrometers in diameter. Microchemical spot tests made on individual particles indicated the presence of NH4, K, Ca, Na and Cl. Whole filter spot tests for K indicated no systematic variation in the concentration of potassium-bearing particles. Approximately 4% of the particles greater than 2 micrometers were soluble salts of Na, K, Mg, and Ca. The concentrations of Na, K, Ca and Mg were measured in melted

fractions of the same core profile by atomic absorption spectrophotometry. Variation of the K concentration and variation of the number of potassium-bearing particles per gram of ice have a correlation coefficient of 0.93 over the 2.5 years of accumulation studied. (Woodard-USGS)  
W74-00334

#### ANTICIPATED CLOSURE RATES FOR A PROPOSED DRILL HOLE, ROSS ICE SHELF, ANTARCTICA,

Cold Regions Research and Engineering Lab., Hanover, N.H.

J. Weertman.

Special Report 190, July 1973. 8 p, 3 fig, 1 tab, 17 ref.

Descriptors: \*Glaciology, \*Rheology, \*Creep, \*Antarctic, Methodology, Data collections, Drill holes, Glaciers, Movement, Velocity, Ice.

Identifiers: \*Ross Ice Shelf (Antarctica).

Closure rates are calculated for the proposed drill hole through the Ross Ice Shelf, Antarctica at 166 deg W, 82 deg 30 min S. Closure rates are calculated using the best experimental data on power law creep of polycrystalline ice. Without pressurization of the drill hole closure rates greater than 0.1% per day are estimated to occur at the bottom of the drill hole. (Woodard-USGS)  
W74-00335

#### QUATERNARY GLACIATION IN TRANSBAYKALIA (CHETVERTICHNOYE OLEDENENIYE ZABAYKAL'YA),

V. V. Zamoruyev.

Vsesoyuznoye Geograficheskoye Obschestvo Izvestiya Vol 105, No 3, p 229-236, May-June 1973. 56 ref.

Descriptors: \*Glaciation, \*Glaciers, \*Glacial sediments, \*Glacial drift, \*Quaternary period, Stratigraphy, Paleoclimatology, Topography, Mountains. Identifiers: \*USSR (Transbaykalia), Glacier recession, Tectonics.

Quaternary glaciation in the Transbaykal Region was of the mountain type and confined to individual mountain massifs. On the basis of generalization of available data, traditional concepts of 'maximum' Middle Quaternary glaciation must be reexamined. The presence of glacial deposits of this age cannot be considered as conclusive evidence. Existing data in the literature on traces of 'maximum' glaciation are contradictory and conflict with present data on evolution of climate and topography. Glaciation was determined by interaction of climatic and tectonic factors, of which climate was the most important. Initial stages of glaciation must be correlated with Middle Quaternary cooling. Greatest glacier development occurred at the end of Late Quaternary time, and formations developed during the maximum stage are clearly defined and relatively thick. Glacier recession in many cases was stadial in character. Glacial deposits at the time of glacier maximum development and subsequent shrinkage can be compared with the Sartanskij horizon in the stratigraphic classification. (Josefson-USGS)  
W74-00343

#### INVESTIGATION OF ICE MOVEMENT ON MOUNTAIN GLACIERS BY STEREOPHOTOGRAFOMETRY (ISSLEDOVANIYE DVIZHENIYA L'DA GORNYKH LEDNIKOV STEREOFOTOGRAMMETRICHESKIM METODOM),

I. F. Knizhnikov.

Izdatel'stvo 'Nauka', Moscow, 1973. 106 p.

Descriptors: \*Photogrammetry, \*Glaciers, Mountains, \*Ice, Movement, Velocity, Rates, Aerial photography, Mapping, Surveys, Measurement, Instrumentation, International geophysical year, International hydrological decade, Equations.

## Field 02—WATER CYCLE

### Group 2C—Snow, Ice, and Frost

Identifiers: \*Caucasus, \*USSR (Tien Shan), \*Stereophotogrammetry, Stereocomparators, Geodesy, Phototheodolites, Second International Polar Year.

Development and present state of application of terrestrial photogrammetry in glaciological investigations, and modern methods of measurement of glacier surface velocities are discussed. Attention is focused on theoretical and experimental research designed to improve the method of pseudo parallaxes employed in the measurement of ice motion at 800 points on Elbrus glaciers in the Caucasus. The rate of ice motion on Elbrus glaciers varies between several millimeters and 140 cm/day (about 0.5 km/year). On the basis of repeated phototheodolite surveys in Central Tien Shan, the rate of ice motion in terminal portions of receding mountain glaciers is several meters a year. The Zeiss phototheodolite 19/1.318 best satisfies the requirements of a glacier survey, although it is not readily adaptable to alpine conditions because of its weight. Results of a stereophotogrammetric determination on ice-motion velocities in 14 glaciers in the Caucasus and Tien Shan in 1955-63 are graphed, tabulated, and mapped. (Josefson-USGS)  
W74-00346

**ANALYSIS OF COUPLED HEAT-FLUID TRANSPORT IN PARTIALLY FROZEN SOIL,**  
Department of the Environment, Ottawa (Ontario). Water Resources Branch.  
For primary bibliographic entry see Field 02G.  
W74-00369

**ALTERNATIVE METHODS OF ESTIMATING SNOW WATER PARAMETERS,**  
Idaho Univ., Kimberly. Water Resources Research Inst.  
D. L. Reese, H. F. Mayland, and C. E. Brockway. Water Resources Research, Vol 9, No 5, p 1433-1439, October 1973. 2 fig, 3 tab, 5 ref.

Descriptors: \*Water yield, \*Snowmelt, \*Statistical methods, Regression analysis, Frequency analysis, Snowpack, Snow surveys, Water equivalent, Runoff forecasting.

A recurrence analysis technique uses probability and contingency relationships of snow depth, water equivalent, and snow density to estimate snow water. Regression techniques are based on the value from the previous month, the value from a reference site, and the month to previous month contingency parameter of the reference course. Correlation of estimated values to measured values indicated equal reliability of recurrence and regression analysis when any of the methods were used. The recurrence technique can successfully be used in estimating snow water and probability of yield. This technique like the regression technique requires a basic data set before it can be applied. (Knapp-USGS)  
W74-00377

**EVIDENCE OF A SURGE ON BARNES ICE CAP, BAFFIN ISLAND,**  
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.  
G. Holdsworth. Canadian Journal of Earth Sciences, Vol 10, No 10, p 1565-1574, October 1973. 8 fig, 1 tab, 22 ref.

Descriptors: \*Glaciers, Movement, \*Glaciology, Glaciology, \*Canada, \*Surges, Regimen, Arctic. Identifiers: \*Glacial surges, \*Baffin Island.

A source on Barnes Ice Cap, Baffin Island is shown by several independent sources of evidence. Recently obtained and previously published flow rate, ice depth, and temperature measurements available in the region of the south dome enable a closer examination of one of the postulated surge areas on the south section of the

south dome. The additional geophysical evidence is also supported by independent observations of a geological-hydrological nature in and adjacent to Generator and Flyway Lakes. It seems likely that the surge occurred in this century. The total area affected was about 240 sq km, including 'transition zones'. The increase in area of the dome was about 35 sq km in the form of the south lobe, and the increase in length of the southwest flow line was about 56%, taking account of the displaced divide. (Knapp-USGS)  
W74-00537

### 2D. Evaporation and Transpiration

**INTENSITY OF PLANT TRANSPIRATION IN CERTAIN VARIETIES AND MUTANT FORMS OF COTTON, (IN RUSSIAN),**  
Akademii Nauk Tadzhikskoi SSR, Dushanbe. Institut Pochovedeniya.  
For primary bibliographic entry see Field 03F.  
W74-00026

**RATE OF EVAPORATION OF LOW-SOLUBILITY CONTAMINANTS FROM WATER BODIES TO ATMOSPHERE,**  
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.  
For primary bibliographic entry see Field 05B.  
W74-00071

**EVAPORATION RETARDATION BY MONOMOLECULAR LAYERS,**  
Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.  
For primary bibliographic entry see Field 03B.  
W74-00373

**EVAPORATION AND COOLING OF A LAKE UNDER UNSTABLE ATMOSPHERIC CONDITIONS,**  
Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.  
R. N. Weisman, and W. Brutsaert. Water Resources Research, Vol 9, No 5, p 1242-1257, October 1973. 10 fig, 3 tab, 26 ref.

Descriptors: \*Evaporation, \*Lakes, Convection, Advection, Winds, Water temperature, Humidity, Turbulence, Boundary processes, Boundary layers, Meteorology, Mass transfer, Diffusion, Heat transfer.  
Identifiers: \*Lake evaporation.

Evaporation from a lake involves turbulent diffusion of momentum, sensible heat, and water vapor in the lower atmosphere when a neutral, dry air mass encounters a warm, wet surface. To calculate evaporation, the water surface temperature is specified, and the surface roughness is taken to be constant over land and water. The turbulent fluxes are formulated by a semiempirical turbulence theory with the Businger-Dyer form of the Monin-Obukhov similarity functions, a water vapor buoyancy term in the Obukhov stability length, and Blackadar's scaling height in the mixing length. The resulting solution of the equations of conservation shows that the stability discontinuity at the leading edge can greatly affect the mean rate of evaporation and that the vertical vapor flux can greatly contribute to the atmospheric stability. The solution is relatively insensitive to the exact form of the Monin-Obukhov similarity functions or to the exactness of Reynolds' analogy or von Karman's constant. For large fetches and near-neutral conditions the solution becomes similar to that obtained in Sutton's problem and with Harbeck's empirical formula. (Knapp-USGS)  
W74-00374

**THE TRANSPERSION OF CORN,**  
Baghdad Univ. (Iraq). Coll. of Agriculture.

G. A. Al-Nakshabandi, and H. N. Ismail.

J Agric Sci. Vol 79, No 3, p 501-507. 1972. Illus.

Identifiers: \*Corn, Irrigation, Neutron probes, Phaseolus-Aureus, Radiation, \*Transpiration, Zea-Mays.

The actual transpiration of corn (*Zea mays L.*) was determined by hydraulic lysimeters, by the inflow-outflow method and by use of a neutron probe. Two irrigation treatments were used; wet and dry. Under the wet treatment 740, 858, and 743 mm of irrigation water was used during the seasons 1968, 1969 and 1970, respectively. Under the dry treatment, irrigation water used was 560, 627 and 565 mm during the seasons 1968, 1969 and 1970, respectively. Ratios of actual transpiration (Et) to Penman's estimate of potential evaporation (Eo), evaporation from a Class-B pan (EpB), global radiation (Rg) and net radiation (Rn) were calculated. Values of Et measured by the different methods are in good agreement. Seasonal averages of Et were 6.2 and 4.9 mm/day under wet and dry treatments, respectively. The Et/Eo, Et/EpB, Et/Rg and Et/Rn ratios increased with leaf area index (L.A.I.) and reached their maximum values when L.A.I. reached its maximum value of 1.03 under wet and 0.92 under dry treatment. The empirical coefficient ( $f \pm Et/Eo$ ) under wet treatments was higher than that given by Penman for short grasses and about the same as that obtained by Boumans et al. for golden-gram (*Phaseolus aureus*) in Iraq for Aug. and Sept. The empirical coefficient Kb in the Blaney-Criddle formula was greater than the value given by Blaney and Criddle for an arid climate, and less than the value obtained by Boumans et al. for golden-gram in Iraq. Water use efficiency for grain production was greater under dry than under wet treatments. Copyright 1973, Biological Abstracts, Inc.  
W74-00467

**WATER REQUIREMENTS OF WHEAT (TRITICUM AESTIVUM L.) FROM METEOROLOGICAL PARAMETERS,**  
Meteorological Service of Canada, Toronto (Ontario).  
For primary bibliographic entry see Field 03F.  
W74-00468

### 2E. Streamflow and Runoff

**PROCESSING OF RESULTS OF OBSERVATIONS OF SPRING DISCHARGE,**  
Ceskoslovenska Akademie Ved, Brno. Geograficky Ustav. H. Kriz.

Ground Water, Vol 11, No 5, p 3-14, September-October 1973. 7 fig, 9 tab, 5 ref.

Descriptors: \*Springs, \*Discharge (Water), \*Statistical methods, Water yield, Time series analysis, Data collections, Hydrologic data, Data processing, Water measurement.  
Identifiers: \*Czechoslovakia.

In Czechoslovakia special methods of mathematical statistics are being used for the treatment of results of long-term observations of spring discharges. Examples are given of the statistical treatment of weekly discharges of springs issuing in the eastern margin of the Bohemian Cretaceous Plateau for the years 1901 to 1970. Besides the usual average and extreme discharges of springs, the characteristic discharge, that is the discharge exceeded for the period of n days or n percent per year, is determined. On the basis of these characteristic values it is possible to rate the individual discharges for a longer time, and with an extraordinarily high or low discharge of springs, to calculate the exceptionality of the occurrence. (Knapp-USGS)  
W74-00096

## WATER CYCLE—Field 02

### Streamflow and Runoff—Group 2E

**DETERMINATION OF LIQUID RUNOFF FROM THE FIRN FIELD OF A GLACIER,**  
For primary bibliographic entry see Field 02C.  
W74-00115

**FLOODS IN JACKSON QUADRANGLE, MISSISSIPPI,**  
Geological Survey, Washington, D.C.  
For primary bibliographic entry see Field 07C.  
W74-00302

**STREAM GAUGING INFORMATION, AUSTRALIA—SUPPLEMENT 1971.**  
Australian Water Resources Council, Canberra.  
For primary bibliographic entry see Field 07C.  
W74-00350

**HYDROLOGY AND SEDIMENT TRANSPORT, MOANALUA VALLEY, OAHU, HAWAII.**  
Geological Survey, Honolulu, Hawaii. Water Resources Div.  
B. L. Jones, and C. J. Ewart.  
Hawaii Department of Transportation, Highways Division Report No HI-HWY-71-1-II, May 1973. 111 p, 14 fig, 15 plate, 8 tab, 25 ref.

Descriptors: \*Streamflow, \*Sediment transport, \*Hydrologic data, \*Hawaii, Rainfall-runoff relationships, Model studies, Data collections, Correlation analysis, Gaging stations, Discharge (Water), Sediment yield, Particle size, Bed load. Identifiers: \*Moanalua Valley (Hawaii).

In November 1970, the State of Hawaii, Department of Transportation, entered into a cooperative agreement with the U.S. Geological Survey to study the hydrology and sedimentation characteristics of Moanalua Valley, Oahu. The primary purpose of this study is the analysis of rainfall-runoff and rainfall-sedimentation relations in a tropical watershed. This report is the first of a series of progress reports on the Moanalua Valley investigation. Preliminary results from the limited use of the U.S. Geological Survey's rainfall-runoff model have been encouraging. The calibration phase based on 10 storms produced a reasonable correlation between simulated and observed peaks. Data collected through July 1972 indicate that Moanalua Stream has a considerable capability of transporting sediment, both as bedload and as suspended sediment. Observations and calculations by the Schoklitsch formulae indicate the stream often moves material in excess of 2 feet in diameter. Calculations of suspended-sediment load, using the instantaneous relation of water and sediment discharge, resulted in a storm load of 12,000 tons for a flood similar to the design flood, or a load equivalent to 4.6 times the computed bedload discharge. (Woodard-USGS)  
W74-00354

**WATER RESOURCES SUMMARY, ISLAND OF HAWAII,**  
Geological Survey, Honolulu, Hawaii.  
D. A. Davis, and G. Yamana.  
Hawaii Division of Water and Land Development Report R47, April 1973. 42 p, 7 fig, 1 map, 45 ref.

Descriptors: \*Water resources, \*Surface waters, \*Groundwater resources, \*Water quality, \*Hawaii, \*Reviews, Hydrologic data, Stream gages, Streamflow, Rainfall, Runoff, Water yield, Groundwater, Water wells, Aquifer characteristics, Geomorphology, Perched water, Water storage, Water analysis, Hydrographs, Maps, Bibliographies.

A summary of existing information on water on the island of Hawaii is presented. Shown on the water resources map are (1) principal streams and ditches on the island and the locations of gaging stations; (2) types of occurrence of groundwater;

(3) locations of principal wells, springs, and development tunnels; and (4) information on depths of wells, groundwater levels, and salinity of groundwater as indicated by chloride content. Graphs show characteristics of flow of streams at selected gaging stations and a brief description is given of development of streamflow. Brief descriptions are given of the rocks and their water-bearing properties and the occurrence, availability, and quality of groundwater. The report was compiled from published reports and records and from unpublished records in the files of the U.S. Geological Survey and the Hawaii Division of Water and Land Development. A list of selected references gives the principal publications containing information on geology and water resources of the island. (Woodard-USGS)  
W74-00355

**A RECONNAISSANCE OF THE WATER RESOURCES IN THE PAHSIMEROI RIVER BASIN, IDAHO,**  
Geological Survey, Boise, Idaho.  
H. W. Young, and W. A. Harenberg.  
Available from Idaho Dept. of Water Admin. Statehouse Annex 2, Boise, Idaho 83707 - Price \$5.00. Idaho Department of Water Administration Water Information Bulletin No 31, June 1973. 57 p, 19 fig, 10 tab, 15 ref, append.

Descriptors: \*Water resources, \*Hydrologic data, \*Streamflow, \*Groundwater resources, \*Idaho, River basins, Water yield, Water quality, Discharge (Water), Sediment transport, Gaging stations, Water wells, Aquifer characteristics, Groundwater movement, Water level fluctuations, Water analysis, Chemical analysis, Water utilization, Irrigation, Water supply, Livestock. Identifiers: \*Pahtsimeroi River basin (Idaho).

The Pahtsimeroi River basin occupies approximately 845 sq mi of east-central Idaho and is tributary to the Salmon River. The economy of the basin is dependent primarily upon livestock raising which in turn is dependent upon irrigation of lands for hay and pasture. A distinctive feature of the basin is the large interchange of water from the surface to the subsurface and back again to the surface. Water from the surrounding mountains seldom reaches the Pahtsimeroi River as direct overland runoff. The Pahtsimeroi River is principally a groundwater fed stream with maximum mean monthly flows occurring in November and minimum mean monthly flows occurring in May. A 7-day mean discharge in excess of 290 cfs occurs on the average of once in about 2 years; and a 7-day low mean discharge of less than about 102 cfs occurs on the average of once every 2 years. The principal aquifer is the alluvial fill from which measured well yields are as high as 3,850 gpm. The major use of water is for irrigation. In 1971, about 120,000 acre-feet of surface water and about 930 acre-feet of groundwater were used to irrigate approximately 27,000 acres. Both the surface waters and groundwater of the basin are of good chemical quality and are suitable for all present uses. Future agricultural development in the basin must rely on the development of its groundwater supplies. (Woodard-USGS)  
W74-00356

**ANNUAL CYCLE IN RIVER WATER QUALITY: A TIME SERIES APPROACH,**  
King's Coll., London (England). Rogate Field Center.  
For primary bibliographic entry see Field 05B.  
W74-00372

**A STREAM LENGTH STUDY,**  
Institute of Hydrology, Wallingford (England). K. Blyth, and J. C. Rodda.  
Water Resources Research, Vol 9, No 5, p 1454-1461, October 1973. 7 fig, 20 ref.

Descriptors: \*Geomorphology, \*Streams, \*Drainage patterns (Geologic), Houghton's law. Identifiers: \*England, \*Stream lengths.

The length of flowing channel in a small clay basin in southeast England was observed once per week over a period of 1 year. The main controls of the total length of flowing channel were found to be the effective rainfall during the previous week and the length of stream flowing at the time of the previous week's observation. Variations in the lengths of streams of different orders were studied, first-order streams being found to vary most. (Knapp-USGS)  
W74-00380

**ON THE ANGULAR ENERGY SPECTRUM OF WIND WAVES,**  
Y. M. Krylov, S. S. Strelakov, and V. F. Tsyplyukin.  
Izvestiya, Academy of Science, USSR, Atmospheric and Oceanic Physics, p 441-446. 5 fig, 2 tab, 14 ref. Trans. from Izv. Akad. Nauk SSSR, Fiz. Atmos. Okeana, Vol 2, No 7, 1966.

Descriptors: \*Beaches, Shores, \*Ocean waves, \*Waves (Water), Refraction, Translation, Coasts. Identifiers: Energy spectrum, Wind waves, Angular spectrum, Wave energy, \*Near shore processes, Surf zone, \*Black Sea, Wind generated waves.

The angular spectrum of deep-water wind waves and its variation in the coastal region is considered. The experimental data on the energy distribution in the angular deep-water spectrum confirm the previously suggested hypothetical dependence upon cosine squared theta. By an analysis of the field measurements and the theoretical calculations it could be shown that the angular spectrum in the narrow coastal region before the breaking zone follows the predictions of a linear hydrodynamic theory which is based on the hypothesis that the flux of wave energy is constant for the individual spectral components. (Sinha-OEIS)  
W74-00505

**SOME STUDIES ON WAVE REFRACTION IN RELATION TO BEACH EROSION ALONG THE KERALA COAST,**  
Indian Ocean Physical Oceanographic Centre of the Indian Ocean Expedition, Ernakulam.  
For primary bibliographic entry see Field 02J.  
W74-00506

**INITIAL WAVE SCATTERING BY AN INHOMOGENEOUS MEDIUM AND ITS APPLICATION TO SHALLOW WATER WAVES,**  
Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science.  
For primary bibliographic entry see Field 02L.  
W74-00513

**WAVE SHOALING,**  
National Engineering Science Co., Pasadena, Calif.  
R. C. Y. Koh, and B. L. Le Maheute.  
Journal of Geophysical Research, Vol 71, No 8, p 2005-2012, April 15, 1966. 7 fig, 9 ref.

Descriptors: Shores, \*Shallow water, \*Energy conservation, \*Waves (Water), \*Coasts. Identifiers: Stokes theory, \*Wave shoaling, Progressive waves, Gravity wave theory.

The transformation of progressive waves as they travel from deep water to the shore is analyzed using the Stokes theory at a fifth order of approximation and the method of conservation of energy flux. The approximation is not uniformly valid because the wave is traveling from deep to shallow water. The first, third, and fifth orders of approxi-

## Field 02—WATER CYCLE

### Group 2E—Streamflow and Runoff

mation are compared with each other and with experiments. The differences between the predictions based on the three orders of approximation are small—of the order of 5%. For most practical purposes the third-order theory would probably give the most reliable results. (Sinha-OEIS)  
W74-00514

#### ON THE ORIGIN OF CERTAIN BREAKERS OFF THE ISLAND OF ARUBA, Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.

W. S. Wilson.

Available from NTIS as AD-677 052; \$6.00 in paper, \$1.45 in microfiche. Report No. TR-43, Ref-68-13, October 1968. 34 p, 14 fig, 5 ref. Nonr-4010(j-1).

Descriptors: \*Beaches, Islands, \*Coasts, \*Waves (Water), \*Refraction, Shoals.  
Identifiers: \*Aruba, Venezuela, Trade Winds, \*Breakers, Swell.

Eastward-traveling swell developing into breakers and having a period estimated to be between 13 and 14 seconds appears intermittently along a beach on the lee side of Aruba, an island lying off the coast of Venezuela in the Trade Winds. It is suggested that waves, generated by winter storms off the mid-Atlantic coast of North America, propagate southward to Mona Passage where they are refracted in a shoal area and that they then propagate across the Caribbean Sea toward Aruba where they are refracted in a shoal area off the northwest tip of the island and arrive on the leeward coast. Evidence is presented to support this hypothesis. (Sinha-OEIS)  
W74-00516

#### WAVE REFRACTION PATTERNS IN HAWKE BAY, Department of Scientific and Industrial Research, Wellington (New Zealand). Oceanographic Inst. For primary bibliographic entry see Field 02L. W74-00518

#### PROCESSES AFFECTING SEAWATER CHARACTERISTICS ALONG THE OREGON COAST, Oregon State Univ., Corvallis. Dept. of Oceanography. J. Pattullo, and W. Denner. Limnology and Oceanography, Vol 10, No 13, p 443-450, July 1965. 4 fig, 1 tab, 10 ref.

Descriptors: \*Coasts, Sea water, \*Oregon, \*Water temperature, \*Salinity, Rainfall, \*Mixing, \*Columbia River, Surface waters, Water properties.

Local processes that modify surface water properties are described. Temperature and salinity data from Oregon coastal waters during 1961 and 1962 are examined to assess the effects of the various processes. The temperature-salinity pairs are divided into sets; each set is considered as dominated by a single modifying process. The set is defined by a process sector on a T-S field. The percentage of observations in each process sector is determined; these provide a basis for quantitative comparison of different samples of data. During winter, rainfall is the dominant process all along the Oregon coast. Rainfall effects were found in 72% of the winter observations. During summer, two other processes dominate: along the northern Oregon coast, mixing with Columbia River water occurred 23% of the time; near Cape Blanco, upwelling in conjunction with heating was found 42% of the time. (Sinha-OEIS)  
W74-00520

#### WATER WAVES AT THE SHORELINE, Wisconsin Univ., Madison. Dept. of Mathematics. A. D. Taylor.

Available from NTIS as AD-478 688; \$6.00 in paper, \$1.45 in microfiche. Report No. TR-1202 (27)/3, July 1965. 54 p, 8 fig, 8 ref. ONR-1202 (27) NR-083-167.

Descriptors: \*Waves (Water), \*Shallow water, \*Beaches, Mathematics, \*Coasts, Equations, \*Shores.

Identifiers: \*Wave action, Bore-free motion, Laplace transform.

The nonlinear equations of two-dimensional wave motion on a shallow beach are used to study motions starting from rest and developing so that the surface elevation, at a fixed distance from the initial shore position, approaches rapidly an approximately simple-harmonic function of time. The Laplace transform is applied to a related problem and is inverted to obtain the solution of the physical problem when the water motion is bore-free. It is shown, moreover, that the solution does represent a bore-free motion for sufficiently small, non-zero amplitude, except at a set of resonant frequencies. (Sinha-OEIS)  
W74-00526

#### SOME ASPECTS OF WAVE ACTION ON A GENTLY SLOPING SANDY BEACH, Akademiya Nauk SSSR, Moscow. Institut Okeanologii.

V. V. Longinov.

International Geology Review, Vol 6, No 2, p 212-227, February, 1964. 5 fig, 3 tab, 25 ref. Translation of: Nekotorye Dannye O Rezhiyem Priboynogo Potoka Na Peshchonoy Pliyazhe Otmelogo Berega v: Akademiya Nauk SSSR, Trudy Okeanograficheskoy Komissii. Vol VIII Morskii Berega, p 136-157.

Descriptors: \*Storms, Surf, \*Beaches, Shores, Coasts, \*Waves (Water), \*Ocean waves, Translation.

Identifiers: Surf zone dynamics, Swash, \*Near shore processes, Wave action, Backwash, Pressure field.

An analysis of surf and swash action during two storms reveals the following: (1) The pressure records generated in the surf zone, and on the upper portions of the fore-shore, exhibit the saw-tooth geometry predicted by theoretical analysis; (2) spacing between pressure peaks decreases down the foreshore with increasing distance from the scarp; (3) recorded pressure peaks, which are indistinguishable from those produced by discreet waves, may be generated by surf beat; (4) as the waves become higher in a coastal storm area, transverse movements of swash give backwash (pressure) effects, which do not correspond to wave and swash pressures recorded for given waves; (5) the fact that the operations were carried out on a straight stretch of fine, sandy beach with rectilinear scarp and very gentle foreshore gradient imposes radical limitations upon the generality of the results. The data were collected during 1956 at the Anapa Research Station of the Oceanographic Institute, on the Black Sea. (Sinha-OEIS)  
W74-00527

#### RECONNAISSANCE OF THE WATER RESOURCES OF BEAVER COUNTY, OKLAHOMA, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W74-00534

#### FLOOD OF JUNE 1972 AT ELMIRA, NEW YORK, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W74-00535

#### DRAINAGE AREAS OF TEXAS STREAMS, LAVACA RIVER BASIN. Geological Survey, Austin, Tex.

Open-file report, September 1973. 1 fig, 1 tab.

Descriptors: \*Drainage area, \*River basins, \*Texas, Locating, Indexing, Mapping, Sites, Streams, Networks.

In 1951 the Federal Inter-Agency River Basin Committee, Subcommittee on Hydrology, designated the U.S. Army Corps of Engineers as the coordinating agency for the determination of drainage areas in the Arkansas and Red River basins. The U.S. Geological Survey was designated as the coordinating agency for all other river basins in Texas. These data are being compiled in cooperation with the Texas Water Development Board. Data on the drainage areas of Texas streams are being compiled so that information of uniform accuracy and reliability will be available for hydraulic, or general engineering use. This report gives the drainage areas as determined by measurements at 61 points within the Lavaca River basin. Tabulated are the latitude and longitude of the points of determination and the drainage area in square miles above each point. (Woodard-USGS)  
W74-00548

#### RIVER MILE INDEX-SAN JOAQUIN RIVER, TULARE LAKE AND BUENA VISTA LAKE BASINS, CALIFORNIA. Bureau of Reclamation, Sacramento, Calif. Mid-Pacific Regional Office.

Pacific Southwest Inter-Agency Committee, Water Management Technical Subcommittee report, May 1973. 121 p, 1 fig.

Descriptors: \*Distance, \*River systems, \*Indexing, \*California, Documentation, River basins, Tributaries, Drainage area, Elevation.

Identifiers: \*River mile index, \*Pacific Southwest, San Joaquin River basin (Calif), Tulare Lake basin (Calif), Buena Vista Lake basin (Calif).

This river mile index for the San Joaquin River, Tulare Lake and Buena Vista Lake basins, California, is one of a series of reports on stream basins in the Pacific Southwest. River mileage designations established on major streams by the Corps of Engineers or the State of California Department of Water Resources have been widely accepted for many years. These designations were used without change where they existed. River mileages for intermediate points and on other streams were determined from independent measurements made on U.S. Geological Survey topographic quadrangles. The U.S. Geological Survey furnished information on stream gage locations, drainage areas, and water elevations at key points. River mile distances were measured upstream from the mouth to the nearest tenth mile. (Woodard-USGS)  
W74-00549

#### RIVER MILE INDEX-KLAMATH RIVER, PACIFIC SLOPE BASIN, CALIFORNIA-OREGON.

Pacific Southwest Inter-Agency Committee, Sacramento. Water Management Technical Subcommittee.

July 1973. 56 p, 1 fig.

Descriptors: \*Distance, \*River systems, \*Indexing, \*California, \*Oregon, Documentation, River basins, Tributaries, Drainage area, Elevation.

Identifiers: \*River mile index, \*Klamath River basin (Calif and Oreg), Pacific Slope basin, Pacific Southwest.

## WATER CYCLE—Field 02

### Groundwater—Group 2F

This river mile index for the Klamath River basin in northern California and southern Oregon is one of a series of reports on major rivers in the Pacific Slope basin. This, in turn, is part of a larger program covering all the major rivers of the Pacific Southwest. Distances and other data were taken primarily from U.S. Geological Survey topographic maps. The U.S. Geological Survey Water Resources Data for California and Oregon was the source for stream gage location, height, and drainage area. Streams are designated by order number to indicate their relationship in the basin network. First order streams are main stem streams with an outlet on the sea. Tributaries to these are second order, etc. In making the index, the river mile distances were measured upstream from the mouth to the nearest tenth of a mile. (Woodard-USGS) W74-00550

## 2F. Groundwater

**GROUND-WATER NITRATE POLLUTION IN RURAL AREAS,**  
Illinois State Water Survey, Urbana.  
For primary bibliographic entry see Field 05B.  
W74-00095

**PROCESSING OF RESULTS OF OBSERVATIONS OF SPRING DISCHARGE,**  
Ceskoslovenska Akademie Ved, Brno,  
Geograficky Ustav.  
For primary bibliographic entry see Field 02E.  
W74-00096

**MODIFICATION OF WATER QUALITY DURING ARTIFICIAL GROUNDWATER RECHARGE,**  
For primary bibliographic entry see Field 04B.  
W74-00116

**THE DUSHANBE ARTESIAN BASIN AND ITS MINERAL AND THERMAL WATERS (DUSHANBINSKIY ARTEZIANSKIY BASSEYN I YEGO MINERAL'NYYE I TERMAL'NYYE VODY),**  
Akademiya Nauk Tadzhikskoi SSR, Dushanbe,  
Institut Geologii.  
For primary bibliographic entry see Field 04B.  
W74-00117

**HYDRAULIC TESTING ACCOMPANYING DRILLING OF FIVE EXPLORATORY HOLES, PICEANCE CREEK BASIN, COLORADO,**  
Geological Survey, Lakewood, Colo.

J. E. Weir, Jr., and G. A. Dinwiddie.  
Available from NTIS, Springfield, Va., 22151 as USGS-3002-2 Price \$5.45 printed copy; \$1.45 microfiche. Contract Report USGS-3002-2, September 1973. 55 p., 40 fig., 1 tab., 1 ref. AEC Contract No. AT (49-16)-3002.

Descriptors: \*Core drilling, \*Core logging, \*Test wells, \*Colorado, \*Hydrologic data, Hydrogeology, Transmissivity, Aquifer characteristics, Water quality, Specific conductivity, Geology, Rocks, Water levels, Jets, Flow, Groundwater movement, Exploration, Watersheds (Basins).  
Identifiers: \*Piceance Creek basin (Colo).

Five exploratory core holes which penetrated alluvium and the Green River Formation were drilled in the Piceance Creek basin, Colorado, and hydrologic information was obtained during drilling. Transmissivity of the rocks tested was low (less than 7,500 gallons per day per foot). Field conductance of fluid discharged during drilling ranged from about 500 to about 29,000 micromhos per centimeter. General conclusions, based on comparison and evaluation of available data, are that (1) the rocks having greatest permeability

penetrated by the five test holes are above the Mahogany ledge zone in the upper part of the Parachute Creek Member of the Green River Formation; (2) groundwater in the penetrated rocks becomes more mineralized with depth, noticeably at and below the Mahogany ledge zone; and (3) the test holes probably are in an area of potential groundwater discharge. (Woodard-USGS) W74-00299

**ARTIFICIAL-RECHARGE EXPERIMENTS AND OPERATIONS ON THE SOUTHERN HIGH PLAINS OF TEXAS AND NEW MEXICO,**  
Geological Survey, Austin, Tex.

For primary bibliographic entry see Field 04B.  
W74-00325

**DIGITAL SIMULATION AND PROJECTION OF WATER-LEVEL DECLINES IN BASALT AQUIFERS OF THE ODESSA-LIND AREA, EAST-CENTRAL WASHINGTON,**  
Geological Survey, Tacoma, Wash.  
J. E. Luzier, and J. A. Skrivan.  
Open-file report, 1973. 56 p., 29 fig., 12 ref.

Descriptors: \*Groundwater resources, \*Hydrologic data, \*Washington, \*Water level fluctuations, Projections, Model studies, Computer models, Analytical techniques, Water wells, Aquifer characteristics, Groundwater movement, Water yield, Water utilization, Groundwater recharge.  
Identifiers: \*Odessa-Lind area (Wash).

A digital computer program using finite-difference techniques simulates an intensively pumped, multilayered basalt-aquifer system near Odessa, Wash. The aquifers now developed are in the upper 1,000 feet of a regionally extensive series of basalt flows of the Columbia River Group, thousands of feet thick and having a slight southwesterly dip. Most of the aquifers are confined. Those in the depth range of about 500 to 1,000 feet are the chief source of groundwater pumped from irrigation wells. Transmissivity of these aquifers ranges from less than 2,700 sq ft per day to more than 40,000 sq ft per day, and storage coefficients range from 0.0015 to 0.006. Projected average annual rates of decline in the Odessa-Lind area during the 14-year period 1967-81 are: (1) from 1 to 9 feet per year if pumping is maintained at the 1970 rate of 117,000 acre-feet per year, or (2) from 3 to 33 feet per year if 1970 pumping is increased to 233,000 acre-feet per year, which includes 116,000 acre-feet per year covered by water-right applications held in abeyance. (Woodard-USGS) W74-00326

**EQUATION FOR ONE-DIMENSIONAL VERTICAL FLOW OF GROUNDWATER: 2. VALIDITY RANGE OF THE DIFFUSION EQUATION,**  
Centro di Ricerca IBM di Venezia (Italy).  
G. Gambolati.

Water Resources Research, Vol 9, No 5, p 1385-1395, October 1973. 14 fig., 8 ref.

Descriptors: \*Groundwater movement, \*Consolidation, \*Compaction, Land subsidence, Subsidence, Deformation, Diffusion, Equations, Aquifer testing, Porous media, Dispersion, Mathematical studies.

The reliability of the parabolic diffusion equation was investigated by solving the rigorous one-dimensional equation of groundwater flow in deforming soils. The dependence of the hydraulic conductivity on the specific weight of water is included. The grain velocity was expanded first. This expansion leads to a nonlinear integro-differential term. An iterative finite element technique of solution was then developed. The true time-dependent pressure head was compared to the standard one. The entire range of variations for the formation parameters was carefully ex-

plored. The usual equation gives satisfactory results in the vast majority of applications. The conditions underlying the approximated theory become critical only when the flow field is to be determined in highly compressible units for strong boundary pressure variations. In this case the solid material movements can no longer be considered small. The pressure head changes are faster than it would appear from the standard solution, and the consolidation process is more rapid than that in the classical Terzaghi's theory. (See also W73-13377) (Knapp-USGS) W74-00327

**DIGITAL MODEL OF THE HYDROLOGIC SYSTEM, NORTHERN HIGH PLAINS OF COLORADO—A PRELIMINARY REPORT,**  
Geological Survey, Denver, Colo.

R. R. Luckey, and W. E. Hofstra.  
Colorado Water Resources Circular 19, 1973. 25 p., 14 fig., 6 ref.

Descriptors: \*Groundwater resources, \*Water level fluctuations, \*Hydrogeology, Colorado, Model studies, Data collections, Correlation analysis, Projections, Water utilization, Withdrawal, Water wells, Groundwater recharge, Hydrology, Aquifers.  
Identifiers: \*Colorado High Plains.

The hydrologic system in part of the northern High Plains of Colorado was modeled using a finite-difference technique and a digital computer. Models were prepared for the eastern part of Kit Carson and of Yuma Counties, a total area of 2,900 square miles. The models were verified within the limits of the field data by comparing observed and simulated changes in water levels in the groundwater reservoir during 1964-71. The verified models were used to predict declines in the water table by the year 2000. The predictions indicated declines in excess of 80 feet in Kit Carson County and in excess of 90 feet in Yuma County. However, by the year 2000, Yuma County still had a large groundwater supply remaining. The models indicated that the specific yield of the aquifer and groundwater withdrawals must be more accurately determined to refine the model results. (Woodard-USGS) W74-00330

**WATER-LEVEL RECORDS, 1969-73, AND HYDROGEOLOGIC DATA FOR BACA AND SOUTHERN PROWERS COUNTIES, COLORADO,**  
Geological Survey, Denver, Colo.  
L. A. Hershey, and T. J. Major.  
Colorado Water Resources Basic-Data Release No 32, 1973. 17 p., 1 fig., 1 plate, 2 tab.

Descriptors: \*Groundwater resources, \*Water wells, \*Water levels, \*Basic data collections, \*Colorado, Hydrogeology, Well data, Water yield, Aquifers, Mapping, Sites.  
Identifiers: Baca County (Colo), Southern Prowers County (Colo).

Water levels measured during 1969-73 are presented for about 270 wells in Baca and southern Prowers Counties, Colo. Details are presented of location, ownership, yield, depth, and other characteristics of 165 wells inventoried. The water levels were measured by the U.S. Geological Survey and Colorado State University personnel. The study is made in cooperation with the Colorado Water Conservation Board as a part of an investigation to identify areas where the groundwater supply is being depleted. The water-level data are needed by State and local agencies to aid in administering and managing the groundwater supply. (Woodard-USGS) W74-00332

**AVAILABILITY OF WATER FROM LIMESTONE AND DOLOMITE AQUIFERS IN**

## Field 02—WATER CYCLE

### Group 2F—Groundwater

**SOUTHWEST OHIO AND THE RELATION OF WATER QUALITY TO THE REGIONAL FLOW SYSTEM,**  
Geological Survey, Columbus, Ohio.  
For primary bibliographic entry see Field 04B.  
W74-00336

**LAKE OKEECHOBEE SEEPAGE MONITORING NETWORK,**  
Geological Survey, Tallahassee, Fla.  
For primary bibliographic entry see Field 04A.  
W74-00337

**WATER-SALT BALANCE OF GROUNDWATER IN THE GOLODNAYA STEPPE IN 1969 (VODNO-SOLEVOY BALANS PODZEMNYKH VOD GOLODNOY STEPPI ZA 1969 GOD).**  
Ministerstvo Geologii, Tashkent (USSR).  
For primary bibliographic entry see Field 04B.  
W74-00340

**GEOLOGY AND GROUND-WATER RESOURCES OF RUSH COUNTY, CENTRAL KANSAS,**  
Geological Survey, Lawrence, Kans.  
For primary bibliographic entry see Field 04B.  
W74-00352

**GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1973,**  
Geological Survey, Salt Lake City, Utah.  
For primary bibliographic entry see Field 04B.  
W74-00353

**WATER RESOURCES SUMMARY, ISLAND OF HAWAII,**  
Geological Survey, Honolulu, Hawaii.  
For primary bibliographic entry see Field 02E.  
W74-00355

**STEADY STATE GROUND MOTIONS CAUSED BY SINGLE-WELL PUMPING,**  
Washington Univ., Seattle. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 04B.  
W74-00361

**TIME SERIES ANALYSIS OF THE HYDROLOGIC REGIMEN OF A GROUND-WATER DISCHARGE AREA,**  
Ottawa Univ. (Ontario). Dept. of Civil Engineering.  
R. E. Jackson, J. A. Gilliland, and K. Adamowski.  
Water Resources Research, Vol 9, No 5, p 1411-1419, October 1973. 4 fig, 18 ref.

Descriptors: \*Time series, analysis, \*Groundwater, \*Discharge (Water), \*Water level fluctuations, Hydrogeology, Variability, Markov processes, Evapotranspiration, Statistics, Precipitation (Atmospheric), Climates, Water balance, Hydrograph analysis, \*Canada.

Time series analysis was employed to examine climatological and hydrogeological variables associated with a groundwater discharge area in Manitoba, Canada. Daily groundwater evapotranspiration and inflow rate were adequately modeled by a first-order Markov process. Nonrandom fluctuations associated with the weather and circulation of the North American summer climate were identified in the time series of mean daily temperature and groundwater evapotranspiration; daily precipitation was random. Statistical filtering of the hydrogeological time series showed that two processes were associated with seasonal maximums in the groundwater evapotranspiration series, one due to the propagation of groundwater recharge through the flow system and the other due to climatic effects on the discharge area, in particular, the Lisse effect. (Knapp-USGS)

W74-00362

**GALERKIN SOLUTION OF THE INVERSE PROBLEM FOR AQUIFER TRANSMISSIVITY,**  
Waterloo Univ. (Ontario). Dept. of Earth Sciences.

E. O. Frind, and G. F. Pinder.

Water Resources Research, Vol 9, No 5, p 1397-1410, October 1973. 11 fig, 20 ref. Canada NRC Grant A 8368.

Descriptors: \*Groundwater movement, \*AQUIFER testing, \*Transmissivity, \*Finite element analysis, Numerical analysis, Equations, Mathematical models, Flow nets.

Identifiers: \*Galerkin method.

The inverse problem in aquifer analysis may be solved by a Galerkin finite element approach. The proposed solution was applied to an inhomogeneous isotropic aquifer for which steady state piezometric head is known and transmissivity is unknown. The condition for existence and uniqueness of a solution is that transmissivity must be known along a line crossed by all streamlines in the flow system. In the Galerkin solution this condition may be stated alternatively in terms of flux, so that knowing the discharge at a well may satisfy the uniqueness requirement. Isoparametric finite elements were used; polynomial shape functions approximated aquifer geometry, hydraulic head, and transmissivity. The flexibility of the isoparametric elements permits using an irregular grid with nodes directly at observation points. The solution is highly sensitive to the degree of approximation in the functional representation of hydraulic head but relatively insensitive to the representation of transmissivity. The finite element solution converges to a unique solution as element size decreases. (Knapp-USGS)

W74-00363

**DISPERSION-AFFECTED TRANSPORT OF REACTING SOLUTES IN SATURATED POROUS MEDIA: GALERKIN METHOD APPLIED TO EQUILIBRIUM-CONTROLLED EXCHANGE IN UNIDIRECTIONAL STEADY WATER FLOW,**

Geological Survey, Menlo Park, Calif.

For primary bibliographic entry see Field 05B.

W74-00364

**ANALYTICAL SOLUTIONS TO THE ONE-DIMENSIONAL NONLINEAR DIFFUSION EQUATION FOR FLOW THROUGH POROUS MEDIA,**  
Geological Survey, Denver, Colo.

A. F. Moench.

Water Resources Research, Vol 9, No 5, p 1378-1384, October 1973. 4 fig, 3 tab, 4 ref.

Descriptors: \*Diffusion, \*Groundwater movement, \*Numerical analysis, \*Porous media, Transmissivity, Equations, Mathematical studies, Soil water movement, Saturated flow, Unsaturated flow.

The one-dimensional nonlinear diffusion equation was solved approximately by an extension of the Neumann method for a step input to a semi-infinite medium. The method of solution requires that the region under consideration be divided into an arbitrary number of zones, each zone having known constant diffusivities. The boundaries between zones move at rates that are initially unknown. Two problems were considered: (1) horizontal flow in an aquifer in which the transmissivity and storage coefficients are functions of hydraulic head and (2) horizontal absorption in an unsaturated soil for which the diffusivity is a function of moisture content. Computational results compare well with finite difference and other numerical solutions to the same problems. The technique has application to other nonlinear problems of the same type. (Knapp-USGS)

W74-00365

**EXPERIMENTAL AND MATHEMATICAL MODELING OF LIQUID-LIQUID MISCIBLE DISPLACEMENT IN POROUS MEDIA,**  
Kansas Univ., Lawrence. Dept. of Chemical and Petroleum Engineering.

S. S. Chhatwal, R. L. Cox, D. W. Green, and B. Ghandi.

Water Resources Research, Vol 9, No 5, p 1369-1377, October 1973. 10 fig, 1 tab, 13 ref.

Descriptors: \*Dispersion, \*Mixing, \*Groundwater movement, Saline water intrusion, Path of pollutants, Diffusion, Numerical analysis, Convection, Mathematical models, Hydraulic models.

When one liquid in a porous medium displaces a second miscible liquid of different density, both gravity effects and dispersion are present at the gravity-liquid interface. Equations describing this process were solved numerically. The method of characteristics numerical solution and a new technique (the centered in distance, centered in time method) were evaluated by direct comparison and by checking against an analytical solution for the case of one-dimensional flow. The solutions were used to simulate saltwater displacement experiments in a two-dimensional laboratory model as a further test. (Knapp-USGS)

W74-00366

**DISPERSION DURING FLOW IN POROUS MEDIA WITH BILINEAR ADSORPTION,**  
Purdue Univ., Lafayette, Ind. School of Chemical Engineering.

For primary bibliographic entry see Field 05B.

W74-00367

**MODIFIED APPROACH TO CAPILLARY HYSTERESIS BASED ON A SIMILARITY HYPOTHESIS,**  
Technion-Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.

For primary bibliographic entry see Field 02G.

W74-00368

**METHOD FOR NUMERICAL SIMULATION OF FLOW IN MULTIAQUIFER SYSTEMS,**  
Illinois Univ., Chicago. Dept. of Geological Sciences.

Z. A. Salem.

Water Resources Research, Vol 9, No 5, p 1465-1469, October 1973. 2 fig, 14 ref.

Descriptors: \*Simulation analysis, \*Numerical analysis, \*Groundwater movement, \*AQUIFER characteristics, Aquicluides, Artesian aquifers, Confined water.

Identifiers: Multiaquifer systems.

A model for simulation of groundwater flow in multiaquifer systems was developed. A system of nonlinear partial differential equations that are isomorphic to groundwater flow in the system was formulated in a finite difference form suitable for the line successive overrelaxation technique. The resulting system of difference equations is solved by using an efficient algorithm. The algorithm serves as a means for solving the bitridagonal system of difference equations representing flow in two aquifers simultaneously. Storativity of the semiconfining layer can be considered indirectly or can be neglected. The results derived from the numerical simulator for the flow to wells in two coupled aquifers are in good agreement with analytical results for the same system. (Knapp-USGS)

W74-00382

**ELECTRICAL RESISTIVITY SOUNDINGS ON THE COASTAL PLAIN OF SOUTHEASTERN VIRGINIA: A FEASIBILITY STUDY,**  
Old Dominion Univ., Norfolk, Va. Dept. of Geophysical Sciences.

M. A. Sabet.

## WATER CYCLE—Field 02

### Water in Soils—Group 2G

Completion Report Submitted to Virginia Polytechnic Institute and State University, Blacksburg, Water Resources Research Center (1972). 17 p, 41 fig, 4 ref.

Descriptors: \*Resistivity, \*Coastal plains, \*Aquifers, Groundwater, \*Virginia, Geophysics, Electrodes.

Identifiers: Tidewater, \*Schlumberger array, Dismal Swamp (Va).

A total of 39 vertical electrical resistivity soundings (VES) were made on the Coastal Plain Region of Southeastern Virginia. The Schlumberger array was used throughout the study. The maximum distance between the current electrodes was 8000 feet. Interpretation of the VES data was made by the curve matching method. Depth and resistivity parameters thus obtained were substituted in a computer program and the results were modified, by trial and error, until the calculated apparent resistivity matched the observed one. The results suggest that the maximum depth to fresh-water-bearing sands is about 40 feet in the Dismal Swamp area; it increases eastwards to 130 feet before it diminishes to 40 feet at the Atlantic Coast. To the west of the Dismal Swamp the maximum depth seems to increase progressively westwards from 55 feet at a site immediately to the west of the Swamp to 930 feet at about 50 miles from the Swamp. In the vicinity of the town of Painter on the Eastern Shore, the maximum depth of groundwater aquifers was interpreted to be between 560 and 920 feet. Alternative interpretations are given for 2 sites, in order to stress the idea that the interpretation of resistivity data is not unique.

W74-00437

**ENTHALP, A COMPUTER PROGRAM FOR THE CALCULATION OF AQUIFER CHEMISTRY IN HOT-WATER GEOTHERMAL SYSTEMS,** Geological Survey, Menlo Park, Calif. Geologic Div.

A. H. Treusdell.

Available from NTIS, Springfield, Va., 22151 as PB-219 376, Price \$4.50 printed copy; \$1.45 microfiche. Computer Contribution (USGS-GD-73-006), March 1973. 72 p, 3 tab, 36 ref, 3 append.

Descriptors: \*Geothermal studies, \*Borehole geophysics, \*Thermal water, \*Computer programs, \*Geochemistry, Water chemistry, Steam, Gases, Aquifer characteristics, Enthalpy, Systems analysis, Wells, Thermal properties, Thermodynamics, Model studies, Analytical techniques, Theoretical analysis.

This program calculates the temperature and chemical conditions in a geothermal aquifer supplying a producing bore. The input includes the enthalpy of the total fluid and the chemical analyses of water and steam separated and collected at known pressures. Alternately if a single water phase exists in the aquifer the complete analyses (including gases) of a sample collected by a downhole sampler are sufficient without a measured value of the total enthalpy. The fundamental assumptions are that the fluid is produced from a single aquifer, and is homogeneous in enthalpy and chemical composition. The calculation, necessarily involving moderately large amounts of auxiliary information and frequent iteration, is well suited to computer methods. (Woodard-USGS) W74-00532

**REGIONAL SPECIFIC YIELD OF THE EDWARDS AND ASSOCIATED LIMESTONES IN THE SAN ANTONIO, TEXAS AREA,** Geological Survey, San Antonio, Tex. R. W. Maclay, and P. L. Rettman. Edwards Underground Water District report, August 1973. 10 p, 3 fig, 1 tab, 4 ref.

Descriptors: \*Aquifer characteristics, \*Specific yield, \*Limestones, \*Texas, \*Groundwater resources, Groundwater movement, Water wells, Water level fluctuations, Hydrographs, Observation wells, Basic data collections.

Identifiers: San Antonio (Tex), \*Edwards aquifer (Tex).

The regional specific yield in the recharge area of the Edwards and associated limestones, the principal aquifer in the San Antonio, Texas, area, is estimated to be about 0.025. This estimate is based on annual differences between recharge and discharge and on the averages of annual water-level changes in 10 observation wells in and near the outcrop area. Illustrations include: map showing recharge and artesian areas of the Edwards and associated limestones; geologic section showing the altitude of the potentiometric surface in January 1961; and hydrographs for observation wells. (Woodard-USGS) W74-00542

## 2G. Water in Soils

### NITRATE AND NITRITE VOLATILIZATION BY MICROORGANISMS IN LABORATORY EXPERIMENTS,

Pennsylvania State Univ., University Park. Dept. of Agronomy.

For primary bibliographic entry see Field 05G. W74-00008

### SOIL DENITRIFICATION IN SEALED SOIL-PLANT SYSTEMS: II. EFFECT OF SOIL WATER CONTENT AND FORM OF APPLIED NITROGEN,

Adelaide Univ. (Australia). Dept. of Agricultural Biochemistry and Soil Science.

R. C. Stefanson.

Plant Soil, Vol 37, No 1, p 129-140, 1972, Illus.

Identifiers: \*Denitrification, \*Nitrogen, Nitrous oxide, Soil systems, \*Soil denitrification, \*Soil-water-plant relationships.

The gaseous losses from N applied to the soil were measured in sealed soil-plant systems. In all treatments, large quantities of N<sub>2</sub> and N<sub>2</sub>O were evolved into the atmosphere of the sealed growth chambers, where nitrate-N was applied; the final concentration of N<sub>2</sub>O and N<sub>2</sub> was closely related to soil water content. Plant growth increased the final concentration of N<sub>2</sub>O and N<sub>2</sub> in these chambers. In the presence of plants, the major component of soil denitrification was molecular N whereas in the absence of plants the main product of denitrification was N<sub>2</sub>O. Application of ammonium-N reduced the losses of soil N as N<sub>2</sub>O and N<sub>2</sub>. In ammonium-N-treated soils, the denitrification product was exclusively N, the quantity of which was not related to soil water content. N uptake by plants was low from the higher fertility sample of the Urrbrae red-brown earth, and the plant increased the soil denitrification. The reverse situation was found in the lower fertility soil sample. Some losses of soil N as ammonia nitric oxide and NO<sub>2</sub> were found from the soil-plant system. (See also W74-00237 and W74-00025).—Copyright 1973, Biological Abstracts, Inc. W74-00014

### SOIL DENITRIFICATION IN SEALED SOIL-PLANT SYSTEMS: III. EFFECT OF DISTURBED AND UNDISTURBED SOIL SAMPLES,

Adelaide Univ. (Australia). Dept. of Agricultural Biochemistry and Soil Science.

R. C. Stefanson.

Plant Soil, Vol 37, No 1, p 141-149, 1972.

Identifiers: Carbon, \*Denitrification, \*Nitrogen, Samples, Sealed, Soil systems, \*Soil denitrification, \*Soil water-plant relationships.

Denitrification was compared in disturbed and undisturbed samples of the Urrbrae red-brown earth placed in sealed growth chambers. With the soil water content at field capacity the losses of N as N<sub>2</sub>N<sub>2</sub>O averaged 1.3 mg N/kg soil/wk. This rate was maintained throughout the experimental period of 6 wk and is similar to that occurring in the field. No significant trends were observed in the final concentrations of N<sub>2</sub> and N<sub>2</sub>O resulting from varying the form of applied N, the presence or absence of plants, the disturbance of the soil, or the rotational histories of the sites sampled. However, the combined organic C contents were similar for the A1 and A2 horizons of the soils taken from the old pasture area and continuously cropped area. (See also W74-00014 and W74-00237).—Copyright 1973, Biological Abstracts, Inc. W74-00025

### MODIFICATION OF THE WAY OF READING THE VALUES OF RESISTANCE MEASURED BY MEANS OF THE PNEUMATIC SOIL RESISTANCE METER (PENETROMETER TYPE), (IN POLISH),

Instytut Uprawy Nowozemienia i Gleboznawstwa, Pulawy (Poland).

For primary bibliographic entry see Field 07B. W74-00051

### RELATIONSHIP BETWEEN PROPERTIES AND AGRICULTURAL SUITABILITY OF SOILS: SOIL COMPLEXES: GOOD WHEAT SOILS, VERY GOOD RYE SOILS, GOOD RYE SOILS (IN POLISH),

Instytut Uprawy Nowozemienia i Gleboznawstwa, Pulawy (Poland). Laboratorium Anal. Glebowych. H. Terlecki.

Pamiet Pulawski, 48, p 41-71, 1971, Illus, English summary.

Identifiers: \*Agricultural soils, Barley, Oats, Rye, Soil, \*Soils, Wheat, Crop yield.

Trials were undertaken both to analyze and synthesize the agricultural properties of pseudopodzolic and brown soils developed from loesses, silts, loams and sands, based on the analytical data and description of 4976 profiles of soils belonging to the following soil-agricultural complexes: good wheat soils, very good rye soils and good rye soils. Each soil profile was characterized in regard to: depth of humic horizon, percentage and total humus content, depth of carbonate occurrence, depth of acidification and deacidification, mechanical composition, texture of soil profile, soil-water condition, degree of soil culture and capability class. Based on these features, the basic agricultural properties of the investigated soil complexes were characterized. The relationship between the texture of soil profile and genetic type and the agricultural suitability of soils was determined. The criteria were more strictly defined regarding the division between the good wheat and very good rye complexes, and the good rye and the very good rye in the range of silty soils as well as loamy and sandy soils. Information is also presented regarding the yield of wheat, barley, oats, and rye on the various soil complexes.—Copyright 1973, Biological Abstracts, Inc. W74-00054

### CONTRIBUTION TO THE KNOWLEDGE OF MINERAL NITROGEN DYNAMICS IN A GREY FERRUGINOUS SOIL AT NIORO-DU-RIP (SENEGAL), (IN FRENCH),

Centre National de Recherches Agronomiques de Bambe (Senegal).

For primary bibliographic entry see Field 03F. W74-00062

### USE OF THE GAMMA FIELD OF THE EARTH TO DETERMINE THE WATER CONTENT OF SOILS,

Gosudarstvennyi Gidrologicheskii Institut, Lenin-

grad (USSR)

## Field 02—WATER CYCLE

### Group 2G—Water in Soils

N. V. Zotimov.

Soviet Hydrology: Selected Papers, No 4, p 313-320, 1971. 4 fig, 5 tab, 16 ref. Translated from Transactions of State Hydrologic Institute (Trudy GGI), No 189, p 38-48, 1971.

Descriptors: \*Soil water, \*Moisture content, \*Radiation, \*Gamma rays, Watersheds (Basins), Bogs, Bulk density, Water storage, Water levels, Instrumentation, Lysimeters, Analytical techniques, Surveys.

Identifiers: USSR.

Field experiments were performed to (1) establish a relation between gamma radiation intensity and soil water content; (2) determine the depth of soil to which this relation can be applied; and (3) develop equipment for surveys of the earth's gamma field to determine average soil water content in catchments. To determine water content at individual stations and during continuous traverse surveying, the relation of natural gamma radiation of the earth to soil water content can be used. The gamma survey method makes it possible to determine water content in soil layers to a depth of approximately 50 cm and to differentiate it by layers within limits of this depth. Under certain climatic and natural conditions, this method can be used to compute water content in the upper 100 cm of soil and in saturated soils. Construction of the relation for a specific catchment requires simultaneous measurement of the gamma field, soil bulk density, and soil water content by the thermostatic-gravimetric method. The error in determining soil water content using this method and fairly simple equipment will not exceed 5%-10%. Use of the gamma survey method to determine soil water content eliminates laborious sampling, drying, and weighing of soil, installation of sensors, and sinking of wells. (Josefson-USGS)

W74-00108

#### APPLICATION, UTILIZATION AND DISPOSAL OF LIVESTOCK WASTES.

Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 05G.

W74-00136

#### MINERALOGY OF PARENT MATERIALS, TOPSOILS AND EROSION PRODUCTS OF TAITA EXPERIMENTAL STATION,

Department of Scientific and Industrial Research,

Lower Hutt (New Zealand). Soil Bureau.

N. Wells, and R. J. Furkert.

N Z J Sci. Vol 15, No 2, p 141-155, 1972.

Identifiers: \*Erosion, Materials, \*Mineralogy, \*New Zealand, Products, Soils, \*Topsoils.

Five parent materials from 38 sites on Taita Experimental Station were analyzed for their mineral content by rapid methods. Very strongly weathered greywacke had a low amount of feldspar and a high amount of halloysite. Four deposits of loess had compositions that related to their degree of weathering and to the presence of volcanic ash. The least weathered loess had high amounts of feldspar. Weathering of volcanic ash gave a parent material with high amounts of amorphous minerals together with some gibbsite. Topsoils analyzed from 11 soils mapped on the station had the following mineralogical character: high amounts of quartz, varying amounts of feldspar, halloysite, vermiculite, illite, interlayered hydrous mica, amorphous minerals and organic matter, with traces of gibbsite, montmorillonite, chlorite, and cristobalite. Analysis of 123 topsoil samples showed the degree of variability within the soil mapping units over the 20 ha of the Station. There was little variation in the Pinehaven silt loam form alluvium or Pomare silt loam from colluvium. Larger variations occurred in: Wingate hill soils from loess, Bucks clay loam from loess plus volcanic ash, and Tawai steepland soils from eroded weathered greywacke. The Taita clay loam from weathered greywacke with a minimum of ac-

cession varied less in its mineralogical composition than did adjacent mapping units. Erosion products analyzed were: stones from steep slopes, stones from stream beds, sandy deposits from stream beds, and silty deposits from the bottom of ponds. Stones from steep slopes had more illite than stones from streams. Sandy deposits in streams had more quartz and amorphous minerals but less feldspar than stones from streams. The mineralogy of the silty sediments from ponds was related to the nature of land use in the catchment. Copyright 1973, Biological Abstracts, Inc.

W74-00122

#### SOIL DENITRIFICATION IN SEALED SOIL-PLANT SYSTEMS: I. EFFECT OF PLANTS, SOIL WATER CONTENT AND SOIL ORGANIC MATTER CONTENT,

Adelaide Univ. (Australia). Dept. of Agricultural Biochemistry and Soil Science.

R. C. Stefanoff.

Plant Soil, Vol 37, No 1, p 113-127, 1972, Illus.

Identifiers: \*Denitrification, Diffusion, Organic matter, Oxygen, Respiration, Roots, Soils, \*Soil denitrification, \*Soil-water-plant relationships.

Evolution patterns and constituent components of denitrification were measured in sealed soil-plant systems. In 2 samples of the Urrbrae red-brown earth containing 1.6 and 2.3% organic C, respectively, the growth of the plant consistently increased the amounts of N<sub>2</sub>O and N<sub>2</sub> from the soil at all water contents below field capacity. At soil water contents above field capacity, the total losses of soil N were limited in the pasture soil (organic C 2.3%) by the amount of nitrate substrate and in the crop soil by the lack of easily decomposable soil organic matter. The yields of plant tops were low in these treatments. In the presence of plants, N<sub>2</sub> was evolved preferentially, while in their absence N<sub>2</sub>O accounts for most of the soil N loss. This trend was most pronounced in the crop soil. The pore space relationships measured at the end of the experiments showed that potential O<sub>2</sub> diffusion pathways were more restrictive in the crop soil than in the pasture soil. The plant effect on soil denitrification was 2-fold, firstly by increasing the demand for O<sub>2</sub> in the soil and secondly by supplying easily decomposable organic matter. (See also W74-00014 and W74-00025).—Copyright 1973, Biological Abstracts, Inc.

W74-00237

#### DEGRADATION OF PARATHION IN FLOODED ACID SOILS,

Central Rice Research Inst., Cuttack (India).

For primary bibliographic entry see Field 05B.

W74-00268

#### SALINITY STUDIES IN EAST GLADES AGRICULTURAL AREA, SOUTHEASTERN DADA COUNTY, FLORIDA,

Geological Survey, Tallahassee, Fla.

For primary bibliographic entry see Field 03C.

W74-00329

#### INFILTRATION PROPERTIES OF SOILS AND INTRAZONAL STRUCTURE OF THE HYDROLOGIC BUDGET (INFILTRATION- NYYE SVOYSTVA POCHV I VNUTRIZONAL'- NYYE OSOBNOSTI STRUKTURY VOD- NOGO BALANSA),

A. M. Grin.

Vsesoyuznoye Geograficheskoye Obshchestvo Izvestiya, Vol 103, No 5, p 463-469, September-October 1971. 5 fig, 15 ref.

Descriptors: \*Infiltration, \*Hydrologic budget, \*Soil properties, Hydrologic properties, Permeability, Soil moisture, Soil types, Rainfall-runoff relationships, Runoff coefficient, Land use, Correlation analysis, Equations.

Identifiers: \*European USSR.

The hydrologic budget of a land-use class is affected by soil physical and chemical properties, which determine the capacity of a soil to absorb, transmit, and retain water. To describe the infiltration capacity of different soils in various uses, investigations were carried out in 1962-70 in forest steppe, steppe, and southern forest zones of European Russia. An empirical relation was established between infiltration capacity of soil and surface-runoff and total-moisture values of an area. Quantitatively determined relations between soil hydrophysical properties and relation of major items in the hydrologic budget of a particular land-use class can be used in routine hydrologic forecasting and in formulating a genetic theory of river runoff formation. (Josefson-USGS)

W74-00341

#### THE EFFECT OF DENSITY ON WATER RETENTION PROPERTIES OF FIELD SOILS,

Soil Survey of England and Wales.

M. J. Reeve, P. D. Smith, and A. J. Thomasson.

Journal of Soil Science, Vol 24, No 3, p 355-367, September 1973. 3 fig, 6 tab, 23 ref.

Descriptors: \*Bulk density, \*Available water, \*Retention, Clays, Soil structure, Soil management, Field capacity, Soil physical properties, Hydrologic properties, Soil texture.

Identifiers: Water retention.

The bulk density, available water, air capacity, and retained water capacity were determined for A, B, and C horizons of 158 field soils, clay, and silt. Statistical analysis of the results demonstrated that bulk density exerts a profound influence on available water, air capacity, and retained water capacity, but the effect varies between texture groups and horizons. Significant negative correlations were obtained between bulk density and air capacity for most texture and horizon groups. In B and C horizons available water and retained water capacity also decrease with increasing density, whereas in A horizons they tend to increase with bulk density. Within a limited range it is feasible to control these soil characteristics by using field techniques to achieve optimum bulk density. (Knapp-USGS)

W74-00358

#### OBSERVATIONS ON THE SOIL-WATER REGIMES IN A DRAINED CLAY SOIL,

Ministry of Agriculture, Fisheries and Food, Cambridge (England). Field Drainage Experiment Unit.

B. D. Trafford, and D. W. Rycroft.

Journal of Soil Science, Vol 24, No 3, p 380-391, September 1973. 6 fig, 2 tab, 17 ref.

Descriptors: \*Drainage, \*Clays, \*Mole drainage, \*Deep tillage, Drainage practices, Soil water movement, Percolation, Chiselling, Soil management.

Identifiers: England.

Soil-water profiles between drains and the associated drain-flow data were measured for the winter period on a clay soil of the Ragdale series, formed in drift over Lias clay in the Midlands of England. A water table exists and the rate of drain flow depends on whether the water table is high enough to be within layers having a better hydraulic conductivity than the normal subsoil. Mole drainage modifies the drainage performance considerably by providing a quicker disposal of water and significantly lower water table subject to much smaller fluctuations in level. Where drains are laid in the natural subsoil, without this being disturbed by deep cultivations, the water-table level is frequently close to cultivation level and there appears to be little water movement in the subsoil. For effective drainage, soils of this type require deep cultivation to modify the subsoil and allow water movement at greater depth. (Knapp-USGS)

W74-00359

## WATER CYCLE—Field 02

### Water in Soils—Group 2G

**SOME ASPECTS OF THE HYDRODYNAMIC DISPERSION OF SOLUTES IN POROUS MATERIALS,**  
Rothamsted Experimental Station, Harpenden (England).  
D. A. Rose.  
Journal of Soil Science, Vol 24, No 3, p 284-295, September 1973. 2 fig, 17 ref.

Descriptors: \*Dispersion, \*Soil water movement, \*Groundwater movement, Porous media, Solutes, Leaching, Path of pollutants, Saturated flow, Mixing.

Identifiers: Hydrodynamic dispersion.

Several methods are given for analyzing the breakthrough curve of one solution as it displaces another from a column of porous material to yield a coefficient of hydrodynamic dispersion. The form of K is a function of particle size and fluid velocity in granular beds composed of solid particles or of aggregates. The effect of K on the dispersion observed in a column of porous material, as fluid velocity and particle size vary, may be used as an aid in assessing the efficiency of leaching. Quantitative aspects of the hydrodynamic dispersion of solute which occurs under the combined influence of convection and molecular diffusion when a solution flows through porous medium are reviewed. Solute is dispersed longitudinally relative to a plane moving with the mean velocity of flow with an apparent diffusion coefficient K termed the coefficient of hydrodynamic dispersion. The medium is considered to be a uniform bed of uniform particle size at a uniform water content. The analysis of breakthrough curves to estimate the dispersion coefficient, which treats K as a constant, is general and thus applies to both saturated and unsaturated media. (Knapp-USGS) W74-00360

**MODIFIED APPROACH TO CAPILLARY HYSTERESIS BASED ON A SIMILARITY HYPOTHESIS,**  
Technion-Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.  
Y. Mualem.

Water Resources Research, Vol 9, No 5, p 1324-1331, October 1973. 8 fig, 23 ref. USDA FG-IS-287.

Descriptors: \*Unsaturated flow, \*Capillary action, \*Hysteresis, Soil water movement, Wetting, Drying, Capillary conductivity, Pores.  
Identifiers: Capillary hysteresis.

A simplified approach to the capillary hysteresis phenomenon is based on a similarity hypothesis. A simple method predicts the relationships between the capillary head and the water content within the hysteretic loop. Only the boundary curves of the main loop are required in order to derive analytically the scanning curves. The reliability of the proposed model is demonstrated by a comparison of the predicted scanning curves with measured ones. The computed results are often in more satisfactory agreement with experiments than those obtained with the use of the general Neel-Everett model. (Knapp-USGS) W74-00368

**ANALYSIS OF COUPLED HEAT-FLUID TRANSPORT IN PARTIALLY FROZEN SOIL,**  
Department of the Environment, Ottawa (Ontario). Water Resources Branch.

R. L. Harlan.  
Water Resources Research, Vol 9, No 5, p 1314-1323, October 1973. 5 fig, 30 ref.

Descriptors: \*Soil water movement, \*Heat flow, \*Frozen soils, Freezing, Thawing, Mass transfer, Temperature, Numerical analysis, Equations, Infiltration, Frost, Frozen ground, Ice.

An analogy can be made between the mechanisms of water transport in partially frozen soils and

those in unsaturated soils. By use of this analogy a Darcian approach may be applied to the analysis of coupled heat-fluid transport in porous media with freezing and thawing. With the aid of a numerical model, freezing-affected soil-water redistribution and infiltration to frozen soil were examined from a phenomenological point of view, and the effects of soil type and initial conditions on the response of a hypothetical soil column were studied. In general, the model shows that the rate of upward redistribution of soil water to a freezing zone at the soil surface decreases from coarse-textured soils to fine-textured soils and decreases with increase in depth to the water table. Subsequent redistribution during melting of the frost wedge occurs at a rate less than that associated with freezing. Infiltration to partially frozen soil has a significant influence on soil-water redistribution and the response of the groundwater table. (Knapp-USGS) W74-00369

**EFFECT OF INSOLUBLE GRAINS ON LEACHATE FROM POROUS BEDS,**  
Syracuse Univ., N. Y. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 05B.  
W74-00379

**EFFECTS OF SOME SOIL CONDITIONS ON SUGAR BEET SEEDLING EMERGENCE,**  
Broom's Barn Experiment Station, Bury St. Edmunds (England).

For primary bibliographic entry see Field 03F.  
W74-00389

**MOVEMENT OF POLLUTANT PHOSPHORUS IN SATURATED SOILS,**  
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 05B.  
W74-00392

**BIOLOGICAL ASPECTS OF AGRICULTURE'S EFFECTS ON ENVIRONMENTAL QUALITY,**  
Kentucky Univ., Lexington. Dept. of Entomology.  
For primary bibliographic entry see Field 05B.  
W74-00396

**ENGINEERING AGRICULTURAL WASTES,**  
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 05D.  
W74-00397

**SOIL CONDITIONS UNDER FEEDLOTS AND ON LAND TREATED WITH LARGE AMOUNTS OF ANIMAL WASTES,**  
Southwestern Great Plains Research Center, Bushland, Tex.  
For primary bibliographic entry see Field 05B.  
W74-00399

**NITRATE CONTENT OF PERCOLATES FROM MANURED LYSIMETERS,**  
Guelph Univ. (Ontario). Dept. of Land Resource Science.  
For primary bibliographic entry see Field 05B.  
W74-00417

**MANURING OF POTATOES ON FEN SILT SOILS IN HOLLAND, LINCOLNSHIRE,**  
Agricultural Development and Advisory Service, Cambridge (England).  
For primary bibliographic entry see Field 03F.  
W74-00422

**CROP YIELDS FROM LAND RECEIVING LARGE MANURE APPLICATIONS,**  
Texas A and M Univ., College Station.

For primary bibliographic entry see Field 03C.  
W74-00425

**EFFECTS OF SWINE LAGOON EFFLUENT ON THE SOIL AND PLANT TISSUE,**  
Iowa State Univ., Ames. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 05D.  
W74-00428

**SULPHUR POLLUTION PATTERNS OBSERVED: LEACHING OF CALCIUM IN FOREST SOIL DETERMINED,**  
Norske Skogforsoksvæsen, Oslo.

For primary bibliographic entry see Field 05B.  
W74-00476

**DYNAMICS OF TRACE ELEMENTS IN LIMAN-MEADOW SOILS OF THE ARID ZONE OF CENTRAL KAZAKHSTAN, (IN RUSSIAN),**  
Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Pochvovedeniya.

For primary bibliographic entry see Field 05B.  
W74-00479

**THE INFLUENCE OF MANURE AMELIORATION TREATMENTS ON PHYSICAL PROPERTIES OF SANDY SOIL, (IN POLISH),**  
Instytut Uprawy Nowozienia i Gleboznawstwa, Baborow (Poland).  
For primary bibliographic entry see Field 03F.  
W74-00484

**A METHOD FOR DETERMINING THE BEHAVIOR OF LONG WAVES CLIMBING A SLOPING BEACH,**  
North Carolina State Univ., Raleigh Dept. of Civil Engineering.  
M. Amein.

Journal of Geophysical Research, Vol 71, No 2, p 401-410, January 15, 1966. 7 fig, 21 ref. NBy-32236

Descriptors: \*Beaches, \*Coasts, Tsunamis, Shallow water, Waves (Water), Computer programs.  
Identifiers: \*Long waves, \*Beach slopes, \*Near shore processes, Explosion waves, Wave runoff.

The motion of periodic long waves in shoaling water and their climb on a sloping beach are determined. One objective was the development of a method which might be useful in the investigation of tsunamis and explosion waves in coastal waters. Results are given for waves with periods ranging from 20 to 200 sec and for beach slopes ranging from 0.05 to 0.10. The propagation of long-period waves is determined by the first-order linear small-amplitude surface wave theory for regions away from the shore and by the first-order nonlinear shallow-water theory for regions near the shore. Calculations by the linear theory were made by using Friedrichs' second asymptotic representation, which is suitable for small beach slopes. Calculations by the nonlinear theory were made on a digital computer by a finite difference technique based on the method of characteristics. In the numerical method, the bre equations are coupled to the equations of the nonlinear theory, and a procedure for the calculation of the wave runoff on the dry sloping beach is given. A primary objective was the development of computer programs for the application of the nonlinear theory to periodic long waves. Instantaneous dimensionless wave profiles as functions of the distance from the shore are presented for several combinations of wave periods and beach slopes. (Sinha-OEIS) W74-00515

## Field 02—WATER CYCLE

### Group 2H—Lakes

#### 2H. Lakes

**COASTAL CURRENTS OF THE WESTERN GULF OF MAINE,**  
Bureau of Commercial Fisheries, West Boothbay Harbor, Maine. Biological Lab.

J. J. Graham.  
International Commission for the Northwest Atlantic Fisheries Research Bulletin, No 7, p 19-31, 1970. 8 fig, 3 tab, 16 ref.

Descriptors: \*Coasts, \*Upwelling, \*Herrings, Ocean currents, Maine.  
Identifiers: Gulf of Maine, \*Coastal processes, Clupea harengus, \*Near shore processes, \*Wind effects, \*Dynamic pressure gradients, \*Shoreline configuration, Surface circulation, Coastal topography, Bottom topography.

Coastal currents during 1962-65 are described for an area extending from the headlands to 28 km offshore and from Cape Ann, Massachusetts (42 deg 39 min N, 70 deg 35 min W), to Machias Bay, Maine (44 deg 40 min N, 67 deg 20 min W). Recoveries of drift bottles confirm the major features of the surface circulation described previously by other authors. Recoveries of sea-bed drifters suggested movement of water shoreward, as well as into bays and estuaries; and along the coast for varying distances. Upwelling is the most prominent feature of the coastal circulation. Exceptions occurred at times when, (1) surface water moved inshore along a dynamic gradient within the eastern sector of the coast, (2) winds, dynamic topography at the surface, and bottom topography directed surface drift shoreward within the central and western portions of the coast, and (3) bottom water moved parallel with the coast. (Sinha-OEIS) W74-00015

**PROBABILITIES OF WAVE CHARACTERISTICS IN THE SURF ZONE,**  
Tetra Tech, Inc., Pasadena, Calif.

J. I. Collins, and W. Wier.

Available from the National Technical Information Service as AD-696 140, \$6.00 in paper copy, \$1.45 in microfiche. Report No. TT-TC-149-1, September 1969. 124 p, 23 fig, 24 ref, 3 append. ONR N00014-69-C-0107.

Descriptors: \*Coasts, Shallow water, Hydrodynamics, Ocean waves, Mathematical models, Computer programs, Refraction, Waves (Water).

Identifiers: Littoral zone, \*Surf zone, \*Near shore processes, \*Longshore currents, Energy flux, \*Coastal processes, Probability distributions, Coastal topography, \*Shoreline configuration.

Utilizing the hydrodynamic relationships for shoaling and refraction of waves approaching a shoreline over parallel bottom contours, a number of probability distributions for breaking wave characteristics are derived in terms of assumed deep water probability densities of wave heights, wave lengths and angles of approach. Some probability densities for wave heights at specific locations in the surf zone are computed for a Rayleigh distribution in deep water. The probability computations are used to derive the expectation of energy flux at various locations in the surf zone. A further application to determine longshore current expectation is proposed. (Sinha-OEIS) W74-00018

**THEORETICAL AND EXPERIMENTAL STUDY OF WAVE ENHANCEMENT AND RUNUP ON UNIFORMLY SLOPING IMPERMEABLE BEACHES,**  
Scripps Institution of Oceanography, La Jolla, Calif.

W. G. Van Dorn.

Available from the National Technical Information Service as AD-636 225, \$3.00 in paper copy,

\$1.45 in microfiche. Report No SIO-66-11, May 1966. 101 p, 15 fig, 26 ref, 4 append, 6 infolds. ONR 2216 (16).

Descriptors: Beaches, Coasts, \*Waves (Water), Shores, \*Shore protection.

Identifiers: \*Near shore processes, \*Coastal processes, \*Beach slope, Incident waves, \*Dispersive wave trains, Wave profile, \*Wave runup prediction, Beach slope, \*Shoaling water, \*Wave propagation, Wave enhancement.

The shoaling enhancement of small-amplitude, dispersive wave trains traveling over uniform, impermeable slopes was observed in a specially-constructed wave channel, where the reproducible wave elevation measurement accuracy was about 0.0005 in. These observations substantially support the enhancement predicted from linear theory (conservation of energy flux) except in very shallow water and on very steep slopes, where accelerative effects become important. On the hypothesis that small-amplitude runup theory might be similarly valid for periodic waves of finite height, provided that the positive incident wave amplitude is replaced by the local crest height above still water, this theory was modified to include the effect of the superrelevation under a wave crest due to profile asymmetry. The modified theory is shown to agree acceptably with runup observations of larger waves previously reported both for breaking and nonbreaking waves. Because solutions to the modified theory cannot conveniently be obtained by manual calculation, a nomograph chart is included, from which runup predictions can be easily made, given only the wave height, period, and water depth a wavelength or so from shore, and the beach slope. Use of this nomograph for non-wave-length or so from shore, and the beach slope. Use of this nomograph for non-uniform slopes, oblique incidence, and non-periodic waves is also discussed. (Sinha-OEIS) W74-00022

**WAVE INDUCED CIRCULATION AND LONGSHORE CURRENT PATTERNS IN THE COASTAL ZONE,**

Tetra Tech, Inc., Pasadena, Calif.

For primary bibliographic entry see Field 02L. W74-00023

**CHARACTERISTICS OF WAVE RECORDS IN THE COASTAL ZONE,**

Army Coastal Engineering Research Center, Washington, D.C.

D. L. Harris.

In: Waves on Beaches and Resulting Sediment Transport, Academic Press, p 1-51, 1972. 19 fig, 6 tab, 28 ref. Also as U.S. Army CERC Reprint 2-73.

Descriptors: \*Coasts, \*Beaches, \*Ocean waves, \*Pressure measuring instruments, \*Aerial photography.

Identifiers: \*Wave measuring instruments, \*Wave spectra, \*Surface waves, Pt. Mugu (Calif), Power spectra, \*Multinodal spectra, \*Near shore processes, \*Coastal processes.

Records from several types of wave gages are compared to obtain a measure of instrumental reliability. Pressure records may give a better measure of surface waves than some gages which record the surface elevation directly. Spectra computed from the records of a five-gage array of pressure gages at Pt. Mugu, California, show that the true spectra consist of a group of narrow spikes, and not a smooth continuous function of frequency. Data from Pt. Mugu and several east coast stations show that multinodal spectra are common. Frequency of maximum energy density in the pressure spectra is different from surface spectra or the velocity spectra. Photographs of waves from space are used to show that long crested waves with no more than slight variation in

direction do occur in the ocean. Aerial photography of a coastal region is used to show that wave conditions can vary significantly within short distances in the coastal region. (Sinha-OEIS) W74-00033

**EFFECTS OF ARTIFICIAL AERATION ON THE CHEMISTRY AND ALGAE OF TWO MICHIGAN LAKES,**  
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.

For primary bibliographic entry see Field 05C. W74-00048

**SOME CONSIDERATIONS OF THE CHEMICAL LIMNOLOGY OF MEROMICTIC LAKE MARY,**  
Wisconsin Univ., Madison. Water Chemistry Program.

For primary bibliographic entry see Field 05C. W74-00064

**THE PROBABLE OCCURRENCE OF HYDROXYLAMINE IN THE WATER OF AN ETHIOPIAN LAKE,**

Haile Sellassi I Univ., Addis Adaba (Ethiopia). Faculty of Science.

For primary bibliographic entry see Field 05A. W74-00067

**SEASONAL VARIATIONS IN SELECTED PHYSICOCHEMICAL CONDITIONS OF A SMALL LAKE IN BRAZOS COUNTY, TEXAS,**  
Texas Water Quality Board, Austin.

R. O. Respass, C. E. Wood, J. M. Inglis, and W. J. Clark.

Southwest Nat. Vol 17, No 3, p 249-263, 1972. Illus.

Identifiers: Lakes, Light, Physicochemical analysis, \*Seasonal, Small lakes, Temperature, \*Texas (Brazos County), \*Dissolved oxygen, \*Turbidity.

Weekly physicochemical analyses, including water temperature, dissolved O<sub>2</sub>, CO<sub>2</sub>, pH, total alkalinity, turbidity, and light transmittance were made for a 1-yr period in a lake of 0.76 ha. Dissolved O<sub>2</sub> and temperature profiles and surface samples for chemical analysis were taken at each of seven stations. Midwater (1.5 m) and deep samples (2.7 m) for chemical analysis were taken at the 3 deepest stations. Thermal stratification persisted for about seven months of the year, and the lake was completely mixed for about 2.5 mo in winter. Below 1.8 m depth dissolved O<sub>2</sub> was less than 1 mg/l for about 4 mo. in summer. CO<sub>2</sub> was present in greater concentrations than has been reported for most other freshwater ponds and lakes, and the total alkalinity and pH were lower than those commonly reported. Turbidity was high and the light transmittance was influenced accordingly. Turbidity and dissolved O<sub>2</sub> seemed to have had the most influence on the capability of the lake to support a diversified aquatic community. Copyright 1973, Biological Abstracts, Inc. W74-00074

**QUALITATIVE AND QUANTITATIVE VARIATION OF NET PLANKTON OF CRAIGHEAD LAKE,**  
Oklahoma State Univ., Stillwater. Dept. of Entomology.

J. H. Nelson, and G. L. Harp.

Southwest Nat. Vol 17, No 3, p 239-248, 1972. Illus.

Identifiers: \*Arkansas (Craighead Lake), Ceratium, Diaptomus, Diffugia, Distribution, Keratella, Lakes, \*Plankton, Qualitative, Quantitative, Soft water.

This study describes the horizontal, vertical, and seasonal variation qualitatively and quantitatively of net plankton in Craighead Lake (Arkansas) and the co-existing physicochemical characteristics.

## WATER CYCLE—Field 02

### Lakes—Group 2H

Further, this formation is compared qualitatively with the results obtained by Barton (1963) concerning the same lake. Craighead Lake is a soft water lake with generally adequate O<sub>2</sub> values throughout the year, maintaining a fairly constant CO<sub>2</sub> level and neutral pH in the upper strata. The lake is biologically poor and the 55 genera of net plankton identified constituted a mean annual standing crop of only 710 organisms/l. Total organisms varied numerically from 168/l to 2254/l on 4 Jan. and 26 April 1969, respectively. *Diffugia*, *Ceratium*, *Diaptomus*, and *Keratella* were the dominant genera, in that order. Vertical distribution of plankton was generally characterized by fewer taxa and greater numbers/l with increased depth. The most striking change in net plankton since 1962-63 was in the composition of the dominant forms. This change, and the overall paucity of plankton organisms in the present study, is largely attributed to the softness of the water and the enlargement of the lake in 1962 by extensive dredging.—Copyright 1973, Biological Abstracts, Inc.

W74-00075

**CHANGES IN FAUNA OF WATER MITES (HYDRACARINA) OF KIERSKIE LAKE, (IN POLISH),**  
Polish Academy of Sciences, Poznan. Inst. of Zoology.  
For primary bibliographic entry see Field 05C.

W74-00078

**THE GROWTH OF PINGOS, WESTERN ARCTIC COAST, CANADA,**  
British Columbia Univ., Vancouver. Dept. of Geography.  
For primary bibliographic entry see Field 02C.

W74-00098

**DISTRIBUTION OF PEAT BOGS ON EARTH, THEIR TYPES AND CHARACTERISTICS, (IN RUSSIAN),**  
N. Ya. Kats.

Bot Zh. Vol 57, No 2, p 198-210. 1972. Illus. English summary.

Identifiers: \*Bogs (Distribution), Eurasia, Eutrophy, Flowering, North America, \*Oligotrophy, \*Peat bogs, Plants, Scheuchzeria, Scirpus-Caespitosus, \*Sphagnum.

In temperate zones of Eurasia and North America change of peat bog types from West to East is observed. In both regions, these types are similar in some features, being distinguished from peat bogs of central parts of the continents (meridional, or West-East symmetry). Similarities are revealed in the following: on plains, peat bogs occupy great area and have thick layer of peat; oligotrophic peats are typical, they often prevail over eutrophic ones; Scheuchzeria, Scirpus caespitosus and Sphagnum, forming the basis of peat bogs, are characteristic for the vegetational cover. In coastal territories (England, Ireland and others) on blanket bogs (as well as in peat) flowering plants are abundant instead of Sphagnum. Peat bogs of temperate zones in the Northern and Southern hemispheres have similarities as well (latitude, or North-South symmetry). They are: raised surface; prevalence of Sphagnum, partly of common species, in vegetation and in peat and 3 sharp distinction in species composition of flowering plants. Symmetry of Northern and equatorial oligotrophic peat bogs (Zund Islands) is seen in following: raised surface; belt-like disposition of vegetation; very acidic peat; furrows draining central parts of bogs and taking water to the outlying ones. There is nothing common in flora. Features of symmetry in cold-temperate and warm-temperate zones (the Caucasus) of the Northern hemisphere are: raised surface; thick acidic Sphagnum-peat; common species of Sphagnum and some flowering plants.—Copyright 1973, Biological Abstracts, Inc.

W74-00147

**NITROGEN SOURCES AND CYCLING IN NATURAL WATERS,**  
Florida Univ., Gainesville. Dept. of Environmental Engineering.  
For primary bibliographic entry see Field 05C.  
W74-00149

**WEED HARVEST AND LAKE NUTRIENT DYNAMICS,**  
North Dakota Univ., Grand Forks. Dept. of Biology.  
For primary bibliographic entry see Field 05C.  
W74-00150

**RATES OF PHOTOSYNTHESIS AND PHYTOPLANKTON GROWTH IN SHAGAWA LAKE, MINNESOTA,**  
Minnesota Univ., Minneapolis. Limnological Research Center.  
For primary bibliographic entry see Field 05C.  
W74-00151

**EUTROPHICATION RESEARCH APPLIED TO WATER QUALITY MANAGEMENT ON THE GREAT LAKES,**  
Department of the Environment, Burlington (Ontario). Centre for Inland Waters.  
For primary bibliographic entry see Field 10A.  
W74-00205

**OCURRENCE AND DISTRIBUTION OF HELMINTH PARASITES OF FISHES FROM LAKE CARL BLACKWELL, OKLAHOMA,**  
Oklahoma State Univ., Stillwater.  
For primary bibliographic entry see Field 05B.  
W74-00230

**FRAZER LAKE SOCKEYE INVESTIGATIONS, 1976,**  
Alaska Dept. of Fish and Game, Kodiak. Research Section.  
For primary bibliographic entry see Field 08I.  
W74-00232

**EFFECTS OF ARTIFICIAL DESTRATIFICATION ON ZOOPLANKTON IN PARVIN LAKE, COLORADO,**  
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Sciences.  
For primary bibliographic entry see Field 05C.  
W74-00243

**LAKE HURON: EFFECTS OF EXPLOITATION, INTRODUCTIONS, AND EUTROPHICATION ON THE SALMOID COMMUNITY,**  
Department of Lands and Forests, Maple (Ontario). Research Branch.  
For primary bibliographic entry see Field 05C.  
W74-00244

**PHYSICAL AND CHEMICAL LIMNOLOGY OF LAKE LEAKE AND TOOMS LAKE, TASMANIA,**  
Tasmania Univ., Hobart (Australia). Dept. of Botany.  
For primary bibliographic entry see Field 05C.  
W74-00283

**POLLUTED SNOW IN SOUTHERN NORWAY AND THE EFFECT OF THE MELTWATER ON FRESHWATER AND AQUATIC ORGANISMS,**  
Oslo Univ. (Norway). Zoological Lab.  
For primary bibliographic entry see Field 05C.  
W74-00287

**LAKE OKEECHOBEE SEEPAGE MONITORING NETWORK,**  
Geological Survey, Tallahassee, Fla.

For primary bibliographic entry see Field 04A.  
W74-00337

**NEW DATA ON HYDROLOGIC REGIMEN OF LAKE SARYCHELEK (NOVYYE DANNYYEE PO GIDROLOGICHESKOMU REZHIMU OZ. SARYCHELEK),**  
O. P. Shcheglova, and A. Kh. Tulyaganov.  
Vsesoyuznoye Geograficheskoye Obshchestvo Izvestiya, Vol 103, No 5, p 418-424, September-October 1971. 6 fig, 1 tab, 9 ref.

Descriptors: \*Lakes, \*Regimen, \*Hydrologic cycle, Water balance, Inflow, Discharge (Water), Lake morphometry, Water levels, Thermal properties, Temperature, Thermal stratification, Turbidity, Water chemistry.  
Identifiers: \*USSR (Lake Sarychelek).

Hydrological and meteorological observations were carried out in 1964-65 on Lake Sarychelek, the third deepest lake in Soviet Central Asia. According to latest figures, the morphometric parameters of the lake are: length—7.5 km; maximum width at the dam—2,280 m; mean width—650 m; surface area—4.92 sq km; maximum depth—234 m; volume—0.483 cu km; and mean depth—98 m. The annual range of water levels in the lake during the period of observations was 43 cm. At the end of April after ice breakup, the water surface temperature approaches 0 deg C. Maximum water surface temperature at the shore (19.8 deg C) was recorded on August 25, 1965. Annual temperature cycle in the lake extends to a depth of about 30 m. A year-round inverse temperature structure is observed below 30 m. The temperature of water at the bottom of the lake is about 5 deg C. (Josephson-USGS)  
W74-00342

**RECONSTRUCTION OF THE WATER BALANCE OF LAKE BALKHASH (REKONSTRUKTSIYA VODNOGO BALANSA OZ. BALKHASH),**  
A. V. Shnitnikov.  
Vsesoyuznoye Geograficheskoye Obshchestvo Izvestiya, Vol 105, No 3, p 223-228, May-June 1973. 4 tab.

Descriptors: \*Lakes, \*Water balance, Inflow, Discharge (Water), Precipitation (Atmospheric), Evaporation, Water levels, Water types, Water resources, Dams.  
Identifiers: \*USSR (Lake Balkhash), Ili River.

Owing to unfavorable natural trends in water resources development and removal of part of the Ili River runoff for economic purposes, the water regime of Lake Balkhash is acquiring properties that are highly detrimental to branches of the national economy which depend on the lake waters. From the State point of view, this situation must be remedied. One solution is to divide the lake into three pools separated by two dams: the Western Balkhash and Lepsa-Karat (Eastern Balkhash) freshwater pools; and the Central or Algazy saline-water pool, which will receive the surplus water of the other two pools. Water-balance computations fully justify such reconstruction and conservation of Lake Balkhash as a major water body. (Josephson-USGS)  
W74-00344

**EVAPORATION AND COOLING OF A LAKE UNDER UNSTABLE ATMOSPHERIC CONDITIONS,**  
Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.  
For primary bibliographic entry see Field 02D.  
W74-00374

## Field 02—WATER CYCLE

### Group 2H—Lakes

**OBSERVATIONS ON THE NITROGEN FIXING POTENTIAL OF THE SURFACE WATERS OF A LARGE IMPOUNDMENT,**  
Oklahoma State Univ., Stillwater. Dept. of Zoology.  
For primary bibliographic entry see Field 05C.  
W74-00436

**ECOLOGY AND PRODUCTION OF THE PROFUNDAL BENTHOS IN RELATION TO PHYTOPLANKTON IN LAKE ESROM,**  
Copenhagen Univ. (Denmark). Freshwater Biological Lab.  
For primary bibliographic entry see Field 05C.  
W74-00466

**THE DYNAMICS OF A GROUP OF PERCHES, PERCA FLAVESCENS (MITCHILL) IN THE GRANDE-ANSE COVE OF PERRON ISLAND IN SAINT-LOUIS LAKE, (IN FRENCH),**  
Montreal Univ. (Quebec). Dept. of Biological Sciences.  
R. Fortin, and E. Magnin.  
Nat Can (Quebec). Vol 99, No 4, p 367-380. 1972. Illus.  
(English summary).  
Identifiers: \*Canada (Saint Louis Lake), Coves, Islands, Lakes, Perca-Flavescens, \*Perches, Tagging, Spawning.

In 1968 and 1969, 9396 perch were tagged on their spawning grounds in Grande-Anse of Ile Perron, Canada. To date, 378 specimens were recaptured by anglers and 63 by biologists. Mean distances from the release point are small: 1.9 km under the ice and 3.9 km in open waters: this demonstrates the sedentary character of these fish. The number of eggs varied from 8000-29,000 for females measuring 190-300 mm. The annual rate of survival (s) for fish of age group VI and older was 54%. The rate of catch per angler and per hour was 0.5 perch during the winter and 4.2 perches in open waters. The annual rate of exploitation was 3.4%. The population density for fishes measuring 190 mm and more was estimated as being 268,000 individuals; the corresponding biomass for Grande-Anse is 21.4 kg/ha. The yield per 1000 g of recruits measuring 161 mm (2 and 1/3 yr old) was 124 g.—Copyright 1973, Biological Abstracts, Inc.  
W74-00470

**ESTIMATION OF FISH PRODUCTION IN THE VOLGOGRAD WATER RESERVOIR, (IN RUSSIAN),**  
Gosudarstvennyi Nauchno-Issledovatel'skii Institut Ozerogno i Rechnogo Rybnogo Khozyaistva, Saratov (USSR).  
T. K. Nebol'sina, and V. P. V'yushkova.  
Zool Zh. Vol 51, No 8, p 1255-1257. 1972. (English summary).  
Identifiers: \*Fish production, Phytoplankton, Reservoirs, \*USSR (Volgograd reservoir), \*Primary production.

An attempt was undertaken to estimate fish productivity through the estimation of productive processes taking place in the water reservoir. The value of used organic substances in the fish derived from primary production and phytoplankton was estimated to be 0.29%.—Copyright 1973, Biological Abstracts, Inc.  
W74-00480

**ROLE OF ULTRANANNOPLANKTON ALGAE IN PRIMARY PRODUCTION IN LAKE BAIKAL DURING THE SUMMER, (IN RUSSIAN),**  
K. K. Votintsev, A. I. Meshcheryakova, and G. I. Popovskaya.  
Gidrobiol Zh. Vol 8, No 3, p 21-27. 1972. Illus. (English summary).  
Identifiers: \*Algae, Dinobryon, Gymnodinium, Lakes, Melosira, \*Nannoplankton, Photosynthesia, Plankton, \*Primary production, Summer, Synchocystis, \*USSR (Lake Baikal).

The results of investigations on productive capacity of ultranannoplanktonic algae in Lake Baikal (USSR) are considered. Their great significance in the total biomass of vegetative plankton as well as high photosynthetic activity are established. The role of these organisms is essential in the production process of Lake Baikal. Genera encountered include Dinobryon, Gymnodinium, Melosira and Synchocystis.—Copyright 1973, Biological Abstracts, Inc.  
W74-00488

**ROLE OF BACTERIA IN THE FEEDING OF ZOOPLANKTON OF THE DNEIPER RESERVOIR, (IN RUSSIAN),**  
Akademiya Nauk USSR, Kiev. Instytut Hidrobiologii.  
For primary bibliographic entry see Field 05C.  
W74-00496

**HYDROBIOLOGICAL INVESTIGATION OF LAKE LERE AND NEIGHBORING PONDS: I. THE PHYSICAL ENVIRONMENT, (IN FRENCH),**  
Office de la Recherche Scientifique et Technique Outre-Mer, Fort Lamy (Chad).  
C. Leveque.  
Cah ORSTOM (Off Rech Sci Tech Outre-Mer) Ser Hydrobiol. Vol 5, No 2, p 161-169. Illus. 1971. English summary.  
Identifiers: Biomass, \*Chad (Lake Lere), Environment, \*Hydrobiological studies, Invertebrates, Lakes, Ponds, \*Rotifera.

A limnological investigation of Lake Lere (Chad) (9 deg 37 min N-14 deg 10 min E) was made in Feb. 1970. The bathymetric study shows that this lake is shallow (6m), with flat bottom and can be classified as a flat tropical lake. Ca is the abundant salt in the water, but the general salt content is low (conductivity: 89 micro mhos). The bottom is homogeneous and essentially muddy. At the time of the study, Rotifera were the main zooplankton. Other invertebrates and the benthic biomass are analyzed.—Copyright 1973, Biological Abstracts, Inc. (See also W74-00502)  
W74-00501

**HYDROBIOLOGICAL INVESTIGATION OF LAKE LERE (CHAD) AND NEARBY PONDS: IV. THE BENTHIC FAUNA,**  
Office de la Recherche Scientifique et Technique Outre-Mer, Fort Lamy (Chad).  
C. Dejoux, L. Lauzanne, and C. Leveque.  
Cah ORSTOM (Off Rech Sci Tech Outre-Mer) Ser Hydrobiol. Vol 5, No 2, p 179-188. Illus. 1971.  
Identifiers: \*Alluroidea, \*Bellamya-Unicolor, \*Benthic Fauna, \*Chad (Lake Lere), Ephemeroptera, Hydrobiological studies, Lakes, Ponds, Trichoptera.

Lake Lere is characterized by a lack of benthic endemics, which is to be expected considering that it marks an area of transition from the Chad to the Niger Basins. However, Lake Lere had fewer species than Lake Chad. Particularity evident is the absence of Ephemeroptera and Trichoptera, Alluroidea worms, and Bellamya unicolor mollusks. Considering the small number of benthic species and the homogeneity of the environment (sediment, physicochemistry of the water), Lake Lere constitutes a much more simple aquatic ecosystem than Lake Chad.—Copyright 1973, Biological Abstracts, Inc. (See also W74-00501)  
W74-00502

## 21. Water in Plants

**SOIL DENITRIFICATION IN SEALED SOIL-PLANT SYSTEMS: II. EFFECT OF SOIL WATER CONTENT AND FORM OF APPLIED NITROGEN,**  
Adelaide Univ. (Australia). Dept. of Agricultural Biochemistry and Soil Science.  
For primary bibliographic entry see Field 02G.  
W74-00237

For primary bibliographic entry see Field 02G.  
W74-00014

**SOIL DENITRIFICATION IN SEALED SOIL-PLANT SYSTEMS: III. EFFECT OF DISTURBED AND UNDISTURBED SOIL SAMPLES,**  
Adelaide Univ. (Australia). Dept. of Agricultural Biochemistry and Soil Science.  
For primary bibliographic entry see Field 02G.  
W74-00025

**ECOLOGICAL AND FLORISTIC CONVERGENCES BETWEEN SEASONAL PLANT FORMATIONS OF TROPICAL AND SUBTROPICAL SOUTH AMERICA,**  
Universidad de Los Andes, Merida (Venezuela). Facultad de Ciencias. G. Sarmiento.

J Ecol. Vol 60, No 2, p 367-410. 1972. Illus.  
Identifiers: Canopy, Diversity, Ecological studies, Floristic studies, Generic composition, Layering, Morphology, Rainfall, \*Seasonal, \*South America, Subtropical, Taxa, \*Tropical, Woody plants.

Four tropical seasonal formations of the Caribbean area of northern South America were compared with 9 seasonal subtropical types occurring in southern South America. Considered were: number of woody families and genera; generic composition; floristic elements; generic diversity; layering; leaf size and leaf type of canopy layer species; number of woody genera with thorny, succulent and aphyllous representatives; mean annual rainfall and number of dry months. The tropical American formations are floristically richer than their equivalent subtropical types; alpha-diversity decreases toward the arid extremes of each series, but in a more irregular way in the subtropical group. Tropical elements predominate in the less seasonal types of both series, whereas the most seasonal formations have a more heterogeneous flora from the distributional viewpoint. A 2-axis ordination of the 13 types is given, showing the relative floristic affinity between them. The Gallery forest of the Parana-Paraguay rivers is the subtropical type closely related to the tropical seasonal formations. Subtropical units are lower and structurally simpler than tropical types occurring under equivalent climate. Each subtropical formation compares best with a more seasonal tropical type. In the subtropical area, the mixed character of leaf type is more evident when only the dominant species in each formation are considered. Subtropical types have significantly smaller leaf sizes, while the proportion of taxa showing xeromorphic features is greater than in the Caribbean types. The group of seasonal formations in the subtropical area varies irregularly, probably due to the combined action of the 2 main environmental stresses: drought and cold.—Copyright 1973, Biological Abstracts, Inc.  
W74-00066

**SOME CHARACTERISTICS OF NECTAR PRODUCTION IN THE MOUNTAIN HONEY PLANTS OF NORTHERN FERGANA (IN RUSSIAN),**  
For primary bibliographic entry see Field 03F.  
W74-00235

**SOIL DENITRIFICATION IN SEALED SOIL-PLANT SYSTEMS: I. EFFECT OF PLANTS, SOIL WATER CONTENT AND SOIL ORGANIC MATTER CONTENT,**  
Adelaide Univ. (Australia). Dept. of Agricultural Biochemistry and Soil Science.  
For primary bibliographic entry see Field 02G.  
W74-00237

## WATER CYCLE—Field 02

### Water in Plants—Group 21

#### LIMITING STEPS IN PHOTOSYSTEM II AND WATER DECOMPOSITION IN CHLORELLA AND SPINACH CHLOROPLASTS.

Institut de Biologie Physico-Chimique, Paris (France).

For primary bibliographic entry see Field 05C.

W74-00238

#### THE EFFECTS OF CARBON DIOXIDE CONCENTRATION ON OXYGEN EVOLUTION AND FLUORESCENCE TRANSIENTS IN SYNCHRONOUS CULTURES OF CHLORELLA PYRENOIDOSA,

Rochester Univ., N.Y. Dept. of Biology.

For primary bibliographic entry see Field 05C.

W74-00239

#### THE AMINO ACID AND SUGAR COMPOSITION OF DIATOM CELL-WALLS,

Woods Hole Oceanographic Institution, Mass.

For primary bibliographic entry see Field 05C.

W74-00240

#### ORIENTATION OF CHLOROPHYLL IN VIVO. STUDIES WITH MAGNETIC FIELD ORIENTED CHLORELLA,

New York Univ., New York. Radiation and Solid State Lab.

For primary bibliographic entry see Field 05C.

W74-00245

#### RUNOFF FORMATION ON MOUNTAIN SLOPES UNDER CARPATHIAN BEECH AND SPRUCE FORESTS,

For primary bibliographic entry see Field 04A.

W74-00338

#### SPRING RUNOFF FROM SMALL CATCHMENTS WITH DIFFERENT FOREST COVER IN THE MOUNTAINS OF GEORGIA,

For primary bibliographic entry see Field 04A.

W74-00339

#### LOSS OF PARTICULATE ORGANIC MATERIALS FROM SEMIARID WATERSHEDS AS A RESULT OF EXTREME HYDROLOGIC EVENTS,

Utah State Univ., Logan. Watershed Science Unit.

For primary bibliographic entry see Field 02A.

W74-00378

#### NUTRIENT LOSSES AFTER CLEAR-CUT LOGGING AND SLASH BURNING IN THE OREGON COAST RANGE,

Oregon State Univ., Corvallis. School of Forestry.

For primary bibliographic entry see Field 04C.

W74-00381

#### DIFFERENCES IN LITTORAL FAUNA DUE TO FLUCTUATING WATER LEVELS BELOW A HYDROELECTRIC DAM,

Amherst Coll., Mass. Dept. of Biology.

S. G. Fisher, and A. Lavoy.

J Fish Res Board Can. Vol 29, No 10, p 1472-1476.

1972. Illus.

Identifiers: \*Chironomid, \*Connecticut River, Dams, Hydro electric plants, Littoral fauna, \*Mollusk, \*Oligochaete, River, \*Water level fluctuation, Invertebrates.

Water level fluctuations below a hydroelectric dam on the Connecticut River produce a freshwater 'intertidal' zone. Along a transect in this zone from high to low water mark benthic invertebrates increased markedly in density and taxonomic diversity. Community composition shifted from chironomid-oligochaete predominance on the most exposed sites to mollusk predominance on the least exposed sites.—Copyright 1973, Biological Abstracts, Inc.

W74-00463

#### SYNOPSIS ON THE BIOLOGY OF THE SHRIMP OF RIO DEL NORTE (CHILE), (IN SPANISH),

Chile Univ., Santiago. Departamento de Biología.

N. Bahamonde, and I. Vila.

Biol Pesq (Chile). 5. p 3-59. 1972. Illus. (English summary).

Identifiers: Biology, \*Chile (Rio-Del-Norte), \*Shrimp, Synopsis.

A synthesis of the data known about the shrimp of the Northern rivers (*Cryphios caementarius Molina*) the only representative of the Palaemonidae family, which can be found in Chile is given. The area of dispersion lies between the river Maipo, Chile, towards the South and the Peruvian spas of the central Southern regions. During the day, the shrimp stays in the deepest parts of the river, either among or under the stones, or it seeks hiding places among the aquatic plants. At dusk, the shrimp increases its activity, moving to shallow places in search of food. It is omnivorous and in a gastric analysis, different remains of Clorophyceae, Cyanophyceae, diatoms, Gastropoda, Mollusca, larvae, Coleoptera and copepod Cyclopoidae were found. Some specimens have reached a cephalothoracic length of 57 mm. (Limari River); the minimal size for females in spawning is 7.2 mm. in the Estero El Culebrón; and 14.3 mm. in river Limari; both sizes are bigger than the specimens observed in Peru. The diameter of the eggs varies from 0.54-0.84 mm. The principal area of birth is generally near the river's mouth. The period of spawning goes from Sept. to May, with higher percentages in Dec., Jan. and Feb. There are some variations according to the hydrographic system that was analyzed. The methods of catching, culture, and fishing control are discussed. The relation between size and weight, sexual dimorphism and composition of the populations studied in the river Limari and stream El Culebrón, in Chile is indicated.—Copyright 1973, Biological Abstracts, Inc.

W74-00471

#### WATER CONTENT IN A PHYTOCOENOSIS, AND WATER BUDGET OF A ECOSYSTEM; OAK-FOREST OF VIRELLES, (IN FRENCH),

Brussels Univ. (Belgium). Laboratoire de Botanique Systématique et d'Ecologie.

G. Schnock.

Oecol Plant. Vol 7, No 3, p 205-226. 1972. Illus.

(English summary).

Identifiers: \*Belgium (Virelles), Drought, Ecosystem, Forests, \*Oak forest, \*Phytocenosis, Seasonal rhythm, \*Water budget.

During the vegetative period, the moisture content of trees decreases during the warm daytime and increases during the nighttime. Besides the daily rhythm, there exists a seasonal rhythm closely related to the tree physiology, successively: important and generalized increment of the moisture content during the buds swelling period; decline, at first rapid, during the foliation stage, afterward slower until the end of the vegetative period; rehydration of trunks and limbs during the coloration and defoliation stage; relatively stable and homogeneous moisture content in all tree parts in winter season. Moisture and drought periods can induce temporary fluctuations of the moisture content of trees. The more the organs are young and functional, the more the water content is high and the more the fluctuations are important. During the whole vegetative period, the water content of the forest of tall trees has increased from 9.7 to 10.5 mm; it is running to 11 mm for the phytocenose ( $W_p \pm$  community water content) and delta  $W_p$  reaches + 1.8 mm (leafy stage) and - 0.6 mm (leafless stage).—Copyright 1973, Biological Abstracts, Inc.

W74-00474

#### THE EVOLUTION OF A DISCRETE BEAVER HABITAT IN THE MACKENZIE RIVER DELTA, NORTHWEST TERRITORIES, Alberta Univ., Edmonton. Dept. of Geography.

D. Gill.

Can Field Nat. Vol 86, No 3, p 233-239. 1972. Illus.

Identifiers: \*Beaver habitats, \*Canada (N.W.T., Mackenzie River), Castor-Canadensis, \*Deltas, Evolution, *Populus balsamifera*, Rivers, Seral community.

The in situ sequence of physical and biological events that creates a discrete beaver (*Castor canadensis kuhli*) habitat in the Mackenzie River Delta is traced through time. Fluvial and sedimentation processes along a shifting channel create an environment that is conducive to the colonization of a poplar (*Populus balsamifera*) seral community. Depressions formed immediately inland from such sites may be colonized by beavers, after which they are adjacent to a large and preferred food source. Selective use by beavers may locally alter the flora to maintain a zootic climax until the site is abandoned. After abandonment, poplar regeneration may once again attract beavers so that a cyclic pattern of use is established.—Copyright 1973, Biological Abstracts, Inc.

W74-00481

#### COMPARATIVE CHARACTERISTICS OF ECOLOGICAL CONDITIONS IN ANNUAL CLEARING AND UNDER A CANOPY IN DRY COTINUS OAK WOODS, (IN RUSSIAN),

A. I. Vainshtain.

Izv Akad Nauk Mold SSR Ser Biol Khim Nauk. 2. p 9-15. 1972. Illus.

Identifiers: Annual, Canopy, Clearing, \*Cotinus, Ecological studies, Evaporation, Light, Moisture, \*Oak, \*Quercus-Petraea, Soils, Temperature, Transpiration.

Under conditions of dry Cotinus oak woods of *Quercus petraea* Liebl., as in fresh types, removal of wood leads to a change in the microclimate of the clearing. However, as a result of thinning of the leaf canopy in sub-crown area, dry conditions are introduced, thus reducing the contrast of microclimatic indices in the woods and in the clearing. In the woods, at noon, an average 63% of the total short-wave radiation and 56% of light energy passes into the clearing through the tree canopy after the vegetation season. The largest difference between temperature indices in the woods and in the clearing is observed in hours of maximum heating. Air is heated on the forest floor, and soil to a depth of 5 cm. Indices of water regime under the forest canopy and in the clearing differ in the course of whole season; however, this difference varies depending on transpiration of the stand and underbrush, in the surface layers also on physical evaporation, and also on summer deposits. Over the course of the entire vegetation season, the soil layer is parched under the forest canopy at a depth of 100-160 cm, i.e., in the main zone of concentration of root systems of trees and underbrush.—Copyright 1973, Biological Abstracts, Inc.

W74-00487

#### LITTER DECOMPOSITION IN THE EVERGREEN RAIN-FOREST OF IVORY COAST, (IN FRENCH),

Office de la Recherche Scientifique et Technique Outre-Mer, Abidjan (Ivory Coast).

F. Bernhard-Reversat.

Oecol Plant. Vol 7, No 3, p 279-300. 1972. Illus.

(English summary).

Identifiers: Arthropods, Calcium, Decomposition, \*Evergreen rain forest, \*Ivory Coast, \*Litter decomposition, Magnesium, Microbial activity, Phosphorus, Potassium, Rain.

Litter break down was studied in a rain forest of south Ivory Coast at 2 sites: a plateau and a talweg. Litter disappeared within 5 mo. in the talweg;

## Field 02—WATER CYCLE

### Group 21—Water in Plants

on the plateau, the time for total disappearance was about 9 mo. The curves of amount remaining versus time are different from the exponential theoretical ones. Analyses showed mineral nutrient losses from the litter. The order of decreasing mobility was K, P  $\pm$  Mg and Ca. The role of some factors was studied. Decomposition rate is greatly dependent on plant species. Mineral nutrient content of leaves was less important than site. The site is an important factor in litter decay; this is partly due to the top soil features and its microflora. Microbial activity in litter is independent on leaf age, the respiration rate is high in freshly fallen leaves, and then decreases greatly. Artificial leaching of the litter showed a rapid loss of the nutrients used by microflora. Litter arthropod number is maximum during the wet season; the role of arthropods in litter decay is variable and difficult to study.--Copyright 1973, Biological Abstracts, Inc.  
W74-00494

### STUDIES ON THE BIOLOGY AND CONTROL OF VAUCHERIA DICHOTOMA FOUND IN FRESHWATERS IN BRITAIN, AIN SHAMS UNIV., CAIRO (EGYPT). FACULTY OF EDUCATION.

A. R. Dowidar, and T. O. Robson.  
Weed Res. Vol 12, No 3, p 221-228, 1972, Illus.  
Identifiers: Chlorophyll, Diquat, Growth, Herbicides, Nutrients, Reproduction, \*Vaucheria-Dichotoma, \*Algae, \*Great Britain (Oxford).

V. dichotoma Ag. plants were collected from a ditch near Crowland and from the River Cherwell at Oxford (England). A nutrient medium is described which allows the growth and sexual reproduction of this alga. Preliminary studies on the control with diquat show that it must be exposed to a concentration of 2 mg/l for 6 hr for the herbicide to be effective. The presence of mud reduces the rate at which chlorophyll disintegrates and hastens the inactivation of diquat.--Copyright 1973, Biological Abstracts, Inc.  
W74-00541

## 2J. Erosion and Sedimentation

### DOUBLE-HUMPED WAVES ON A SLOPING BEACH, HAWAII INST. OF GEOPHYSICS, HONOLULU.

J. P. Butler.  
Report HIG-67-16, August 1967. 29 p, 6 fig, 5 ref. Also as ESSA-JTRE-2.

Descriptors: \*Waves (Water), \*Beaches, \*Erosion, \*Deposition (Sediments), \*Shallow water.  
Identifiers: \*Wave action, \*Beach slope, Wave propagation.

The nonlinear shallow water theory in two dimensions has been used to compute the behavior of selected wave shapes on sloping beaches. These waves are initially at rest with two humps of specified heights. An analytic solution is found for the behavior of the wave height and velocity at the shoreline. Particularly interesting are the amplifications of the respective humps, when related to the wave shape. Numerical techniques are used to find the general behavior of the wave off the shoreline. (Sinha-OEIS)  
W74-00016

### A TIME SERIES FROM THE BEACH ENVIRONMENT, ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABS., MIAMI, FLA.

W. Harrison, E. W. Rayfield, J. D. Boon, III, G. Reynolds, and J. B. Grant.  
Technical Memorandum ERLTM-AOL-1, January 1968. 28 p, 4 fig, 4 tab, 14 ref, 9 plates, 3 append.

Descriptors: \*Beaches, \*Time series analysis, \*Waves (Water), Rainfall, Water temperature, Air temperature, Winds, Sands, \*Sediment transport, Virginia.

Identifiers: Virginia Beach, \*Coastal processes, \*Near shore processes, Radiant energy, Wind speed, Longshore currents, Breakers, Bottom topography.

A continuous, 26-day series of measurements of the following variables was made at Virginia Beach, Virginia, during August and September, 1966: depth of the water table in the foreshore, altitude of the foreshore surface, tidal elevation, angle between breaker crest and shoreline, height of breaking waves, period of breaking waves, rainfall, radiant energy balance over water, water temperature, air temperature, wind speed, wind direction, velocity of longshore current, position of the top of the uprush, position of the inshore margin of the breaker zone, and the height and period of significant waves 240 m offshore. Water and sand samples were also collected. Additional measurements derived from the samples or field data consisted of: significant breaker height, foreshore slope, quantity of foreshore sand eroded or deposited in one tidal cycle, mean time for sand samples to fall 1.0 m in fresh water, nominal grain diameter and sorting coefficient of foreshore samples, length of unsaturated foreshore surface from outcrop of water table to wash reach, length of saturated foreshore surface from water table outcrop to trough in front of breaking wave, elevation of water table outcrop above trough level at breaking, rate of rise or fall of the tidal plane, density of the sea water, and relative density of midforeshore sand grains. Most of the variables were measured every 4 hr; a few were measured every 6.25 hr, at times of high or low water, and three variables were measured continuously. Plots of the variables were prepared, smooth curves drawn, and the curves digitized using 1-hr interval. A listing of the basic time series is presented, together with details of measurement techniques, analytical procedures, and operational definitions for each variable. (Sinha-OEIS)  
W74-00017

### QUATERNARY BEACHES AND COASTS BETWEEN THE RUSSIAN RIVER AND DRAKES BAY, CALIFORNIA, CALIFORNIA UNIV., BERKELEY. HYDRAULIC ENGINEERING LAB.

C. R. Minard, Jr.  
Available from the National Technical Information Service as AD-733 280, \$3.00 in paper copy, \$1.45 in microfiche. Report no. HEL-2-35, August 1971. 223 p, 29 fig, 84 ref, 2 append. DACW72-71-C-0024.

Descriptors: Beaches, Coasts, \*Shore protection, \*Erosion, \*Sedimentation, Geologic history, \*Sediment transport, California.

Identifiers: \*Coastal processes, \*Near shore processes, Littoral zone, Sea level variations, Progradation, \*Sand transport, Geomorphology, Heavy minerals, \*Longshore transport.

Conditions were studied which in the past promoted or inhibited the movement of large quantities of sand down the coast of northern California from the Russian River to Double Point, and these conditions were compared with those at present. The influence of erosion and deposition on the sand budget was studied. Modern and ancient wave-cut platforms, sea cliffs, beaches, and coastal dunes were examined in the field and on air photos, and reconnaissance-type maps were drawn of these features. Heavy mineral analyses determined the source of deposits along the coast. Swells from the northwest move sand downcoast from northern California, but there is little net longshore transport west of the San Andreas Fault between the Russian River and Double Point. Sand carried by the river and coastal streams east of the fault is trapped upcoast at Tomales Bay. The

headland at western Point Reyes blocks the sand flow. Beaches of the area contain heavy minerals from various sources. (Sinha-OEIS)  
W74-00019

### SAND MOVEMENT IN RELATION TO BEACH TOPOGRAPHY, LOUISIANA STATE UNIV., BATON ROUGE. COASTAL STUDIES INST.

D. S. McArthur.  
Available from the National Technical Information Service as AD-693 123, \$6.00 in paper copy, \$1.45 in microfiche. Report No. TR-67, June 30, 1969. 26 p, 14 fig, 3 tab, 28 ref.

Descriptors: \*Sediment transport, \*Beaches, \*Topography, \*Sands, Waves (Water), Shoals, \*Shallow water, Tracers, Sand bars, Currents (Water), Florida.

Identifiers: Hurricane Island (Florida), Alongshore transport, \*Coastal processes, \*Near shore processes.

Tracer experiments were conducted on the Gulf Coast beach of Hurricane Island, Florida, to obtain information on sediment transfer between foreshore, trough, and bar topography. Concurrent measurements of waves and currents were collected. Along-shore transport of tracer released in the three topographic zones was greater than normal-to-shore movement, even when the angle between wave crests and the shoreline was small. Seaward movement of tracer placed in the trough and bar zones took place during alongshore transport only when waves broke on the bar, and was most marked when wave steepness had a value near 0.04. During these conditions tracer released in the trough moved onto and along the bar crest. At other times landward displacement of bar and trough tracer accompanied alongshore transport. Tracer placed on the bar moved into the trough. Only when a subaqueous shoal replaced the trough immediately seaward of the beach step did appreciable amounts of tracer move seaward from the foreshore. Rhythmic topography appears, therefore, to provide an important mechanism for onshore-offshore movement of sediment within a beach system. Transport of tracer from the trough and bar onto the foreshore was negligible over all experiments. (Sinha-OEIS)  
W74-00020

### EQUILIBRIUM CHARACTERISTICS OF SAND BEACHES, MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF CIVIL ENGINEERING.

P. S. Eagleson, B. Glenn, and J. A. Dracup.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 89, No 1, pt 1, Proceedings Paper 3387, p 35-57, January 1963. 11 fig, 2 tab, 17 ref.

Descriptors: \*Shallow water, \*Sediment transport, Erosion, Deposition (Sediments), Beaches, Sands, Equilibrium.

Identifiers: Suspended sediments, Beach profiles.

The principal problem under study is the equilibrium configuration of sand beaches in the zone offshore of appreciable breaker influence. Use is made of previous theoretical and experimental studies of the mechanics (bed load) of the motion of discrete spherical sediment particles moving on a plane, impermeable, sloping beach due to the action of shallow-water waves. Equations are developed which express the profile of an equilibrium sand beach in terms of the incident deep-water wave characteristics and the fluid and sediment properties. The offshore boundary condition of this equation is shown to govern not only the seaward limit of profile modification by the given wave but also whether, with respect to its initial configuration, the new equilibrium profile requires an aggradation or degradation in the offshore zone. Laboratory experiments using sand

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beaches of essentially uniform particle size provide reasonable confirmation of the theoretical prediction of the seaward extreme of profile modification and of the equilibrium profile in this region. Breaker effects, including the movement of suspended sediments, unaccounted for in the theory, distort the actual profile shoreward of this area. The experiments, together with those of another investigator, verify in all cases the aggrading-versus-degrading offshore profile classification given by the theory, thereby providing the engineer with a rational classification criterion that appears to be an improvement over the conventional technique which is based solely on the deep-water wave steepness. (Sinha-OEIS)  
W74-00027

**REORIENTATION OF CONVEX SHORES,**  
Florida State Univ., Tallahassee.  
W. F. Tanner.  
American Journal of Science, Vol 260, No 1, p 37-43, January 1962. 2 fig, 15 ref.

Descriptors: \*Shores, \*Sedimentation, Equilibrium, \*Littoral drift, \*Beaches, \*Coasts, Energy loss, Shoaling, Beach erosion.

Identifiers: Wave refraction, Scalloped shorelines, Carolina Bays, Sand prism, Curvature, Convex shores.

Convex shores are commonly marked by downdrift decreases in energy. These decreases are due to wave refraction. Shores of this type develop an equilibrium outline by a combination of updrift erosion and downdrift deposition. The resulting form is a concavity or embayment having a radius of curvature equal to about one-fourth of the effective fetch. Several such concavities, with their intervening spits and shoals, may give the shore a 'scalloped' look; bays and lagoons having shores shaped in this fashion have been described as 'segmented'. The oval marshes known as the 'Carolina Bays' formerly may have been lakes that were given their nearly circular outlines in the same way. Not all coastal concavities are due to this process, however, and not all equilibrium shores have the scalloped outline. (Sinha-OEIS)  
W74-00028

**DYNAMICS OF SWASH AND IMPLICATION TO BEACH RESPONSE,**  
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.  
E. Waddell.

Available from the National Technical Information Service as AD-760 699, \$3.00 in paper copy, \$1.45 in microfiche. Technical Report No. 139, March 1973. 49 p, 47 ref. ONR NOOO14-69-A-0211-0003. Proj. NR 388 002.

Descriptors: \*Beaches, \*Erosion, \*Deposition (Sediments), \*Sediment transport, \*Sand waves, \*Groundwater, Beach erosion, \*Shallow water, \*Waves (Water), Florida.

Identifiers: Santa Rosa Island (Florida), \*Coastal processes, \*Near shore processes, Swash, Collision.

A field investigation on a natural sand beach of the swash process and the interaction of swash with input waves, beach ground water, and beach sand levels was conducted on Santa Rosa Island, Florida. During uprush and the initial part of backwash, the leading edge of the uprush behaved in a manner similar to that of a unit mass released upward on a frictionless slope with an initial momentum and acted on only by the downslope component of gravity. The initial momentum at the base of the slope was higher than expected from characteristics of input waves. Inundation periods under the swash predicted by the nonlinear wave theory of Shen and Meyer (J. Fluid Mechanics 16:108-125 1962) agreed with the data within 30%. However, whereas the theory predicted only a single water depth maximum associated with the

uprush, the data exhibited two water depth maxima within a single swash cycle: one associated with uprush and another with backwash. The second maximum, which occurred only on the lower beach, resulted from either (1) a retrogressive bore growing in height while moving seaward or (2) collision between backwash and the uprush from a succeeding swash. The phenomenon of collision was characteristic of real swashes and was a direct result of periodic input waves. The collision process was ignored in the mathematical theory of Shen and Meyer, which was based on consideration of a solitary input wave. Swash power spectra consistently displayed three prominent peaks. The beach ground water level exhibited fluctuations of both interswash and beat frequencies. Sand level data revealed the possible presence of low amplitude sand waves which persistently migrated downslope during both erosion and nonerosion. These sand waves exhibited an average celerity on the order of 3-10 cm/sec and a -2 power frequency dependence below the equilibrium subrange. (Sinha-OEIS)  
W74-00032

**CHARACTERISTICS OF WAVE RECORDS IN THE COASTAL ZONE,**  
Army Coastal Engineering Research Center, Washington, D.C.  
For primary bibliographic entry see Field 02H.  
W74-00033

**CONGO SUBMARINE CANYON AND FAN VALLEY,**  
Scripps Institution of Oceanography, La Jolla, Calif. Geological Research Div.  
F. P. Shepard, and K. O. Emery.

The American Association of Petroleum Geologists Bulletin, Vol 57, No 9, p 1679-1691, September 1973, 10 fig, 11 ref.

Descriptors: \*Submarine canyons, \*Africa, Erosion, Continental shelf, Turbidity currents, Sediment transport, Estuaries.

Identifiers: \*Congo submarine canyon.

Seventeen transverse profiles of the inner 400 km of the Congo Canyons and the Congo Fan Valley were made during a 4-day study in June 1972. These profiles show that the canyon is V-shaped with side slopes 400-1, 400 m high between the coast and a point 240 km seaward, where the axial depth is about 2,700 m. Farther seaward, the continuation as a fan valley narrows and is bordered by levees a few tens of meters high. Distributaries continue for at least an additional 320 km to depths of 4,900 m. Seismic profiles show that the canyon has been cut through a belt of diapirs. The absence of a broad delta at the mouth of the Congo River, the presence of a possible temporary fill at the head, a steep axial slope near the head, a submerged fan bordering the seaward side of the diapir belt, and levees at depth support the concept of origin of the canyon-fan-valley system largely through erosion and deposition by turbidity currents. Tidal-current scour probably helps to limit the amount of fill in the canyon head. (Knapp-USGS)  
W74-00093

**GRAIN SIZE STUDIES ON TURBIDITE COMPONENTS FROM TYRRHENIAN DEEP SEA CORES,**

Kiel Univ. (West Germany). Geologisch-Palaeontologisches Institut und Museum.  
M. Sarnthein, and C. Bartolini.  
Sedimentology, Vol 20, No 3, p 425-436, August 1973, 6 fig, 2 tab, 15 ref.

Descriptors: \*Particle size, \*Bottom sediments, \*Turbidity currents, Sands, Sedimentation, Sedimentology, Stratigraphy, Sediment sorting.

Identifiers: \*Turbidites, \*Tyrrhenian Sea, Pumice.

Through an analysis of their coarse-grain composition, pumice-rice sandy layers from deep sea cores were identified as shelf-derived turbidites rather than deposits due to ash fall or drifting pumice. A comparison of median sizes of individual grain types and total samples yielded significant trends in vertical and horizontal sorting, which allowed samples from different cores to be grouped into proximal and distal parts of one turbidite type. Planktonic molluscs and foraminifera have diameters 1.1 to 2.75 times larger than those of pumice. Weathered shallow-water skeletal materials have diameters approximately equal to pumice, whereas those of augite and hornblende are 1.25 to 2.3 times smaller. This results in a different proportion of components in proximal and distal turbidite samples. (Knapp-USGS)  
W74-00100

**HOLOCENE METEORIC DOLOMITIZATION OF PLEISTOCENE LIMESTONES, NORTH JAMAICA,**  
Texas Univ., Austin. Dept. of Geological Sciences.  
L. S. Land.  
Sedimentology, Vol 20, No 3, p 411-424, August 1973, 3 fig, 7 tab, 20 ref.

Descriptors: \*Diagenesis, \*Limestones, \*Dolomite, \*Groundwater, Sea water, Carbonates, Ion exchange, Water table, Magnesium, Calcium.

Identifiers: \*Jamaica.

Removal of the unstable carbonate phases aragonite and Mg-calcite, and precipitation of calcite and dolomite is currently taking place where phreatic waters invade 120,000-year-old Pleistocene biolithites (Falmouth Formation), North Jamaica. Pleistocene rocks presently in the vadose zone are relatively unaltered, and consist of mineralogically unstable scleractinian biolithites. At the water table, a narrow zone of solution (a water table cave) is commonly encountered. Below the water table the rocks are invariably more highly altered than those above. Mg-calcites are very rare, and considerable dissolution of aragonite has commonly occurred. Dolomite occurs as 8-25 micrometers, subhedral to euhedral crystals replacing micrite, or precipitated as void linings. The isotopic composition of the dolomite and its high strontium content suggest precipitation as meteoric groundwaters oversaturated in  $\text{CO}_2$  invade the mineralogically unstable biolithites and dissolve Mg-calcites and Sr-rich aragonites. Because some dolomitized rocks are enriched in magnesium relative to unaltered biolithites, addition of magnesium to the system has occurred; it is probably derived from sea water in the mixing zone. Phreatic meteoric diagenesis is a rapid process, and it is capable of dolomitization. (Knapp-USGS)  
W74-00101

**EFFECT OF COMPACTION ON CHEMISTRY OF SOLUTIONS EXPelled FROM MONOMORILLONITE CLAY SATURATED IN SEA WATER,**

University of Southern California, Los Angeles. Dept. of Petroleum Engineering.  
G. V. Chilingarian, C. T. Sawabini, and H. H. Rieke.

Sedimentology, Vol 20, No 3, p 391-398, August 1973, 4 fig, 1 tab, 18 ref.

Descriptors: \*Connate water, \*Sea water, \*Clays, \*Compaction, Bottom sediments, Water chemistry, Ion exchange, Montmorillonite, Clay minerals, Leaching, Diagenesis.

The total mineralization of solutions squeezed out of montmorillonite clay saturated in sea water was determined at different overburden pressures. The subsequent fractions of expelled solutions were also analyzed for  $\text{Cl}$ ,  $\text{SO}_4$ ,  $\text{HCO}_3$ ,  $\text{F}$ ,  $\text{Na}$ ,  $\text{K}$ ,  $\text{Mg}$ ,  $\text{Ca}$ , and  $\text{B}$ . The concentrations of squeezed-out

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solutions during the initial stages of compaction (at pressures up to 35 kg/sq cm) are slightly higher than that of interstitial solution present initially. The concentration of squeezed-out solution goes through a maximum, or at least remains constant, before starting to decrease with increasing overburden pressure. (Knapp-USGS)  
W74-00102

**USE OF THE MODEL T COULTER COUNTER IN SIZE ANALYSIS OF FINE TO COURSE SAND,**  
University of East Anglia, Norwich (England).  
School of Environmental Sciences.  
I. N. McCave, and J. Jarvis.  
Sedimentology, Vol 20, No 2, p 305-315, May 1973. 6 fig, 2 tab, 8 ref.

Descriptors: Particle size, \*Instrumentation, Sieve analysis, Electrical conductivity, Calibrations.  
Identifiers: \*Particle size analysis.

An electrical sensing-zone particle size analyzer was calibrated for use with sands. A saline/glycerol electrolyte is used with a concentration of 0.1-0.5 g/liter of suspended sand. Calibration error is 1.6%. Comparison of counter and sieving results shows close agreement. Advantages of the machine are rapidity—a prepared sample can be analyzed in 60 sec—and the small size of the sample required. (Knapp-USGS)  
W74-00103

**WHISTLING SAND BEACHES IN THE BRITISH ISLES,**  
London Univ. (England). School of Pharmacy.  
K. Ridgway, and J. B. Scotton.  
Sedimentology, Vol 20, No 2, p 263-279, May 1973. 9 fig, 19 ref.

Descriptors: \*Beaches, \*Sands, \*Particle size, \*Particle shape, \*Sediment sorting, Beds (Stratigraphic), Continental shelf, Sediments, Sedimentology.  
Identifiers: \*Whistling sands, \*United Kingdom.

Beaches which squeak or whistle when walked on have been known for many years. Sand from 33 beaches in the British Isles whistles. Size distributions of all these sands were obtained by sieving, and the particle shape distribution in the peak size fractions was measured by using a vibratory shape-sorting table. A physical mechanism is suggested for the production of the whistle, which depends upon a close size grading coupled with a spherical grain shape. The locations at which whistling sand occurs correlate quite well with the landward ends of bed-load parings in the continental shelf sand transportation pattern as determined from side-scan Asdic surveys. (Knapp-USGS)  
W74-00104

**SETTLING BEHAVIOUR RELATED TO SIEVE ANALYSIS OF SKELETAL SANDS,**  
Dundee Univ. (Scotland). Dept. of Geology.  
C. J. R. Braithwaite.  
Sedimentology, Vol 20, No 2, p 251-262, May 1973. 4 fig, 12 ref.

Descriptors: \*Settling velocity, \*Particle shape, \*Particle size, \*Sieve analysis, Sands, Limestones, Carbonate rocks, Carbonates, Sediments, Sedimentation, Sedimentology.  
Identifiers: \*Skeletal sands, Bioclastic sediments.

The settling velocities of 1000 grains selected from sieved samples of bioclastic sand were individually measured in a 250-cm column of sea-water. Four fall regimes are represented: straight fall, spinning and spiral modes, and erratic tumbling. As size increases grains pass through this series at rates dependent upon shape and effective density. Computed best-fit curves for velocities at intermediate diameters and an

equivalent sphere of intermediate diameter illustrate considerable divergencies in behavior between the grain types and shape classes examined. Current methods of analysis of carbonate sediments, by sieving, by grain-counting of components, and by sedimentation balance, provide different kinds of information which have no simple relationship to each other. (Knapp-USGS)  
W74-00105

**CARBONATE CEMENTATION OF SOME PLEISTOCENE TEMPERATE MARINE SEDIMENTS,**  
Southampton Univ. (England). Dept. of Geology.  
I. M. West.  
Sedimentology, Vol 20, No 2, p 229-249, May 1973. 6 fig, 1 tab, 35 ref.

Descriptors: \*Dogenesis, \*Limestones, \*Calcite, Sands, Leaching, Ion exchange, Sandstones, Beaches, Carbonates, Carbonate rocks.

Carbonate cementation of some carbonate and quartz sands in three raised beaches of temperate origins was derived from the dissolution of skeletal debris. The sandstones now possess only low magnesium calcite, but the original sediments, like adjacent modern beach and blown sands, probably contained low magnesium calcite, aragonite, and some high magnesium calcite, all of skeletal origin. The dissolution occurred within minute tubules of sand. Concurrent deposition in adjacent volumes of sand of low magnesium calcite formed cements that are irregularly nodular or uneven on a small scale. Aragonite within the minute nodules was replaced paramorphically by low magnesium calcite. (Knapp-USGS)  
W74-00106

**SELECTIVE TRANSPORT OF HEAVY MINERALS BY SHOALING WAVES,**  
Florida State Univ., Tallahassee. Dept. of Geology.

J. P. May.  
Sedimentology, Vol 20, No 2, p 203-211, May 1973. 3 fig, 1 tab, 12 ref.

Descriptors: \*Sediment transport, \*Beaches, \*Sands, \*Surf, Mineralogy, Sediment sorting, Waves (Water), Sedimentation, Sedimentology, Beds (Stratigraphic), Hydraulic models, Model studies.

Identifiers: \*Heavy minerals.

A model to account for the occurrence of heavy mineral concentrations as discrete lamina on beaches is based on the shoreward variation in the distribution of bottom fluid velocities due to shoaling water waves. This variation causes some portions of the sediment population to be transported shoreward at a faster rate than other portions. On moderate energy shorelines composed of sand-sized sediment the selectively transported portion may include the relatively hard-to-move heavy mineral fraction. Wave tank experiments with artificially prepared sediment populations provide empirical support for the proposed model. Under some conditions of water depth and wavelength, the heavy mineral fraction of the sediment population moved shoreward at a faster rate than did the light mineral fraction. (Knapp-USGS)  
W74-00107

**MINERALOGY OF PARENT MATERIALS, TOPSOILS AND EROSION PRODUCTS OF TAITA EXPERIMENTAL STATION,**  
Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau.  
For primary bibliographic entry see Field 02G.  
W74-00182

**PROTEIN ADSORPTION BY SUSPENDED SEDIMENTS: EFFECTS OF PH, TEMPERATURE, AND CONCENTRATION,**  
Alaska Univ., College. Inst. of Water Resources.  
For primary bibliographic entry see Field 05B.  
W74-00293

**IN SITU MEASUREMENT OF SEDIMENT SOUND SPEED DURING CORING,**

Texas Univ., Austin. Applied Research Labs.  
D. J. Shirley, A. L. Anderson, and L. D. Hampton.  
Available from NTIS, Springfield, Va. 22151, AD-758659 Price \$3.00 printed copy; \$1.45 microfiche. ONR Contract N00014-70-A-0166-0005.

Descriptors: \*Core drilling, \*Bottom sediments, \*Oceanography, \*Acoustics, \*Sounding, Velocity, Instrumentation, Analytical techniques, Sedimentology, Logging (Recording), Drilling, Electrical properties, Electrical equipment, Data collections, Geology, Gulf of Mexico, Coasts.

A system has been developed for attachment to sediment corers to obtain an in situ sound speed profile during a coring operation. The system uses two electroacoustic transducers mounted in the cutting head of the corer and associated electronic circuitry to measure the travel time of an acoustic pulse traversing the diameter of the sediment core. Laboratory and field tests which demonstrate the capabilities of the measurement technique are reported. Results show accurate in situ sound speed values as well as sound speed variations which have high correlation with sediment lithology. Sound speed profiles were obtained in the Gulf of Mexico using a piston corer and in coastal waters using a special shallow water coring rig. Limited examination of the feasibility of measuring acoustic attenuation and volume scattering is also reported. The conclusion is that these measurements should be incorporated in the sound speed measurement technique reported here. (Woodard-USGS)  
W74-00294

**SEA-SURFACE CIRCULATION, SEDIMENT TRANSPORT, AND MARINE MAMMAL DISTRIBUTION, ALASKA CONTINENTAL SHELF,**  
Alaska Univ., College. Inst. of Marine Science.

G. D. Sharma, F. F. Wright, and J. J. Burns.  
Available from NTIS, Springfield, Va., 22151 as E73-10370 Price \$3.00 printed copy; \$1.45 microfiche. Contract Report for NASA Goddard Space Flight Center, February 20, 1973. 33 p, 13 fig, 3 ref, 2 append.

Descriptors: \*Sediment transport, \*Water circulation, \*Remote sensing, \*Aerial photography, \*Satellites (Artificial), \*Alaska, Oceans, On-site investigations, Correlation analysis, Currents (Water), Data collections, \*Continental shelf.  
Identifiers: \*Cook Inlet area (Alaska), \*Bering Sea, Chukchi Sea.

Water and sediment movements and factors controlling sea mammal distribution were observed from ERTS multi-spectral scanner imagery. Emphasis during the first half year was upon data from the Cook Inlet area of southern Alaska and from the Bering Sea and Chukchi Sea of the northwest. Relatively, both these areas are accessible for ground truth observations, and the weather permitted the collection of useful ERTS imagery. The Bristol Bay area has also provided satisfactory imagery and it is anticipated that information from the extreme eastern end of this area will be available in useful quantities. The major effort was to obtain synchronous ground truth and satellite imagery. This is pertinent to the total understanding of the ERTS-1 imagery. Undoubtedly the sediments in the water column as observed from the ERTS imagery reflect the sources and movement of sediments and thereby elucidate the coastal sea surface circulation pattern. Detailed interpretation of sediment distribu-

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tion and water circulation on the entire shelf, however, requires a more cautious approach. The turbid water as observed in the ERTS-1 imagery could be a result of biological material as well as sedimentary material. (Woodard-USGS)  
W74-00298

**PATTERNS OF SEDIMENT TRANSPORT AT NEARSHORE ZONES INFLUENCED BY WAVE AND TIDAL CURRENTS: A STUDY UTILIZING FLUORESCENT TRACERS,**  
Skidaway Inst. of Oceanography, Savannah, Ga.  
For primary bibliographic entry see Field 02L.  
W74-00301

**CONTINUITY OF TURBIDITY CURRENT FLOW AND SYSTEMATIC VARIATIONS IN DEEP-SEA CHANNEL MORPHOLOGY,**  
Oregon State Univ., Corvallis. School of Oceanography.  
P. D. Komar.  
Geological Society of America Bulletin, Vol 84, No 10, p 3329-3337, October 1973. 9 fig, 17 ref.  
NSF Grant GA-32122.

Descriptors: \*Submarine canyons, \*Turbidity currents, \*Channel morphology, Continental shelf, Erosion, Geomorphology, Sedimentation, Sediment transport, Pacific Ocean.  
Identifiers: \*Cascadia Channel (Pacific Ocean).

When a turbidity current flow decreases in velocity due to a decrease in bottom slope, the thickness of the flow must correspondingly increase to maintain continuity of discharge. This increase is a possible explanation for observed systematic increases in the relief of submarine channels along their lengths. A simplified computer model of turbidity current flow along a channel indicates that without any dilution of the flow by water entrainment, a reasonable decrease in channel-axis slope could more than double the thickness of the flow. With dilution, the thickness could easily increase by a factor of four or more. The approach was applied to Cascadia Channel, located off the coast of the northwest United States, to test whether reasonable amounts of flow dilution could account for the observed increase in channel relief. Continuity of flow could explain much of the increase, but subsequent channel erosion has to be called upon to account for the entire increase in channel cross-sectional area. (Knapp-USGS)  
W74-00348

**CALCIUM CARBONATE CEMENTATION OF ALLUVIAL FANS IN SOUTHERN NEVADA,**  
Cincinnati Univ., Ohio. Dept. of Geology.  
For primary bibliographic entry see Field 02K.  
W74-00349

**HYDROLOGY AND SEDIMENT TRANSPORT, MOANALUA VALLEY, OAHU, HAWAII,**  
Geological Survey, Honolulu, Hawaii. Water Resources Div.  
For primary bibliographic entry see Field 02E.  
W74-00354

**SOME STUDIES ON WAVE REFRACTION IN RELATION TO BEACH EROSION ALONG THE KERALA COAST,**  
Indian Ocean Physical Oceanographic Centre of the Indian Ocean Expedition, Ernakulam.  
P. K. Das, V. Hariharan, and V. V. R.  
Varadachari.

Proceedings of the Indian Academy of Sciences, Vol 64, No 3, p 192-202, September 1966. 6 fig, 3 tab, 6 ref.

Descriptors: \*Waves (Water), \*Refraction, \*Beach erosion, Sedimentation, Deposition (Sediments), Ocean waves, Coasts, \*Indian Ocean.

Identifiers: \*India (Kerala coast), \*Wave refraction, \*Near shore processes, Short period waves, Longshore currents.

Using the British Admiralty bathymetric charts off the West Coast of India and employing the graphical method of constructing wave refraction diagrams, an attempt is made to study the behavior of the short-period waves (4, 5, and 6 seconds) which are found to affect the coast generally in the neighborhood of Cochin Port entrance. Nineteen stations, at intervals of roughly one mile, are chosen around the three-fathom line in this area. Considering a probable field of approach of deep-water waves, limited to a cone of 90 degrees, five directions of approach are chosen at intervals of 22 1/2 degrees in the range of 202 1/2 degrees to 292 1/2 degrees. Refraction diagrams are prepared for these directions and periods, and from these, the refraction functions and directional parameters are evaluated for each station. The possible directions of flow of long-shore current and the areas vulnerable to erosion and sedimentation are investigated. (Sinha-OEIS)  
W74-00506

**MECHANISM OF SAND MOVEMENT ON COASTAL DUNES,**  
California Univ., Berkeley. Dept. of Civil Engineering.  
A-L. A. Kadib.

Journal of the Waterways and Harbors Division, American Society of Civil Engineers, Vol 92, No WW2, Proceedings Paper 4817, p. 27-44, May 1966. 1 tab, 13 ref.

Descriptors: \*Sediment transport, \*Coasts, \*Littoral drift, \*Wind erosion, Saltation, Sediment load, \*Dune sands, \*Beaches.

Identifiers: \*Near shore processes, Water transport, Wind transport, Wind action, Sand dunes.

The investigation, concerned with the study of the mechanism of sand movement by wind action, developed a method for calculating the rate of sand transport. This method is based on the Einstein theory for sediment transport in rivers and most available field and laboratory measurements on sand movement by wind. The main findings can be summarized as follows: The turbulence or velocity pulsations are largely responsible for sand movement by wind and their effect should be introduced. The description of the transport rate based on the effect of saltation only is misleading and the variation in the flow conditions at the bed should be included. Basically, the main principles governing the rate of sediment transport by water and air are the same. The only difference appears to be the effect of saltation in disturbing the bed surface in the case of air. The method is applicable for calculating the rate of sand transport under a wide range of wind velocities and for sand sizes ranging from 0.145 mm to 1.00 mm. (Sinha-OEIS)  
W74-00509

**NATURAL INDICATORS OF ESTUARINE SEDIMENT MOVEMENT,**  
Oregon State Univ., Corvallis. Dept. of Oceanography.

For primary bibliographic entry see Field 02L.  
W74-00512

**STUDIES ON THE CURRENTS IN THE LITTORAL ZONE OF THE WALTAIR BEACH,**  
Andhra Univ., Waltair (India). Dept. of Meteorology and Oceanography.

R. Ramanadham, R. Varadarajulu, and B. R. Reddi.

Indian Journal of Pure and Applied Physics, Vol 3, No 7, p 269-271, July 1965. 1 fig, 6 ref.

Descriptors: \*Deposition (Sediments), Sands, Harbors, Littoral, Shores, Circulation, Currents, \*Sediment transport, \*Coasts, \*Shallow water.  
W74-00522

Identifiers: \*India (Waltair Beach), Breaker zone, wave rays, Littoral currents, \*Littoral processes.

With a view to understanding the various processes responsible for the deposition of the sand in the harbor entrance channel, a study of the currents near the shore of the Waltair beach has been made using a light spherical float. The general circulation beyond the breaker zone and the littoral currents have been found to be in opposite directions. The magnitude of the currents increases towards the shore and the currents are in the same direction as that of the wave-rays. The direction of the littoral currents is towards the harbor entrance channel during the month of February. (Sinha-OEIS)  
W74-00519

**COASTAL PROCESSES AROUND THE OTAGO PENINSULA,**  
Otago Univ., Dunedin (New Zealand). Dept. of Geology.

W. A. Hodgson.  
New Zealand Journal of Geology and Geophysics, Vol 9, No 1/2, p 76-90, July 1966. 7 fig, 15 ref.

Descriptors: \*Coasts, \*Beaches, \*Waves (Water), \*Refraction (Water waves), Shores, \*Shallow water, Sediments, \*Sediment transport, Drowned (Submerged), Littoral drift, Seashores, \*Sand spits.

Identifiers: \*New Zealand (Otago Peninsula), Swell, Longshore drift, Breaker zone.

Observations of the wave conditions around the Otago Peninsula were made during the period December 1963 to December 1964. From these observations the influence of sea and swell waves in developing the beaches and spits of this part of the Otago coastline has been assessed. The beaches, including the 'southward' - pointing spits of the peninsula, have developed largely in response to a dominant southerly swell of 10-15 sec. period, in spite of intense refraction. North of the peninsula, in an area sheltered from the swell, the dominant waves are produced by the north-easterly sea, which promotes some beach drift from north to south. The energy of dominant waves and the evolution of shoreline curves on a coast of submergence are discussed. (Sinha-OEIS)  
W74-00521

**BEACH NOURISHMENT FROM OFFSHORE SOURCES,**  
Gee and Jenson Construction Engineers, Inc., West Palm Beach, Fla.

H. C. Gee.  
Journal of the Waterways and Harbors Division, American Society of Civil Engineers, Vol 91, No WW3, Proceedings Paper 4428, p 1-5, August 1965. 2 fig.

Descriptors: Beaches, \*Beach erosion, \*Coastal engineering, Coastal structures, Shore protection, Sea walls, Groins (Structures), \*Engineering structures, Coasts, \*Shallow water, \*Florida.  
Identifiers: Beach nourishment, \*Jupiter Island (Fla.).

Jupiter Island, Florida, suffered severe damage to its ocean front in 1962. Heavy swells in March and Northeast storms in November and December removed most of the material from the ocean beach and exposed bulkhead walls to severe wave attack. Emergency dredging was used to place 60,000 yd of material on the beach, structures were reinforced by use of granite boulders and construction of groins, but the problem of continuing beach nourishment was solved in a unique manner. A drag-scraper was used to excavate material from the offshore bottoms, a distance of 800 ft seaward of ordinary high water. This beach nourishment program from offshore sources has been in progress for two summers; results to date (1965) are encouraging. (Sinha-OEIS)  
W74-00522

## Field 02—WATER CYCLE

### Group 2J—Erosion and Sedimentation

**SALINITY OF INTERSTITIAL WATER IN A SANDY BEACH,**  
Chicago Univ., Ill. Dept. of the Geophysical Sciences.  
For primary bibliographic entry see Field 02L.  
W74-00523

**EFFECTS OF THE ALASKA EARTHQUAKE AND TSUNAMI ON RECENT DELTAIC SEDIMENTS,**  
Scripps Institution of Oceanography, La Jolla, Calif.  
E. Reimnitz, and N. F. Marshall.  
Journal of Geophysical Research, Vol 70, No 10, p 2363-2376, May 15, 1965. 12 fig, 9 ref. Nonr 2216 (23).

Descriptors: \*Coasts, \*Tsunamis, \*Alaska, Sediments, \*Deltas, Erosion, \*Sedimentation, Seiches, \*Earthquakes, Ecology.  
Identifiers: Tidal flats, Salt marshes, Barrier islands.

The Alaska Good Friday earthquake (its epicenter about 80 mi from the Copper River delta) and the events associated with the quake left indelible marks on the recent sediments of the delta. A relatively dense pattern of earthquake shock structures is found in the upper part of the section. These include sand dikes, sand pipes, slumps, faults, and joints. The structures increase in abundance toward the central part of the delta, where sediments are thickest, and become rare along its fringes, where sediments are thinnest. The 6-ft uplift of the region was responsible for some erosion and other immediate changes. But the establishment of a new equilibrium, biologically as well as geologically, for barrier islands, tidal flats, and marshes, will advance only gradually over the next few years. Seiches, brought about by the earthquake, with current velocities of up to 20 or 30 knots, regionally planed off the upper 2 or 3 ft of the tidal flats. These areas often are marked by accumulations of clam shells. The eroded materials were dumped into deep channels and troughs. (Sinha-OEIS)  
W74-00524

**TIDAL VARIATION OF THE SIZE DISTRIBUTION OF SUSPENDED SEDIMENT AT A STATION IN THE CHESAPEAKE BAY TURBIDITY,**  
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.  
For primary bibliographic entry see Field 02L.  
W74-00525

**SOME ASPECTS OF WAVE ACTION ON A GENTLY SLOPING SANDY BEACH,**  
Akademija Nauk SSSR, Moscow. Institut Okeanologii.  
For primary bibliographic entry see Field 02E.  
W74-00527

**AN EXPERIMENTAL STUDY OF HEAVY-MINERAL SECRESSION UNDER ALLUVIAL-FLOW CONDITIONS,**  
Geological Survey, Washington, D.C.  
L. L. Brady, and H. E. Jobson.  
Available from Sup Doc, GPO, Washington, D.C. 20402 - Price \$0.85. Professional Paper 562-K, 1973. 38 p, 24 fig, 7 tab, 38 ref, append.

Descriptors: \*Sediment transport, \*Alluvial channels, \*Sedimentation, \*Sediment distribution, \*Mineralogy, Model studies, \*Rio Grande River, Sands, Sedimentology, Particle size, Suspended solids, Bottom sediments, Sampling, Cores, \*New Mexico.  
Identifiers: \*Heavy mineral segregation (Sedimentation), \*Ilmenite, \*Magnetite, Opaque minerals.

Segregation of opaque minerals (mainly ilmenite and magnetite) from the light minerals in a natural sand was observed in a large (61 x 2.44 x 1.22 me-

ters) recirculating water-sediment flume. Bed material (medium size 0.286 millimeter) used in the study was taken from the Rio Grande near Bernardo, N. Mex. Opaque heavy minerals (medium size 0.144 millimeter) amounted to 0.38% of the bed-material volume. Significant hydraulic variables and the sorting and bedding patterns of the bed material were observed for four different bed configurations: a flat bed (upper flow regime), a transition bed, and two different dune beds (lower flow regime). Accumulations of opaque heavy minerals were formed as three basic types: (1) thin accumulations of small extent that were associated with the upstream or stoss slopes of dunes; (2) accumulation associated with the topset deposits of large dunes and with dunes formed in the transition flow; and (3) accumulations associated with the flat-bed condition. The most important factors influencing the type and amount of accumulation of opaque heavy minerals are bed configuration and grain density. The most widespread deposits were the segregations of heavy minerals associated with the base of the flat beds. (Woodard-USGS)  
W74-00533

## 2K. Chemical Processes

**INTERACTION OF BULK PRECIPITATION, STREAM WATER, AND SEWAGE IN A SMALL WATERSHED NEAR OXFORD, MISSISSIPPI,**  
Mississippi Univ., University Dept. of Geology and Geological Engineering.  
For primary bibliographic entry see Field 02A.  
W74-00005

**GAS-CHROMATOGRAPHIC DETERMINATION OF SELENIUM,**  
Kentucky Dept. of Health, Frankfort. Instrumentation Lab.  
J. W. Young, and G. D. Christian.  
Analytica Chimica Acta, Vol 65, No 1, p 127-138, June 1973. 3 fig, 3 tab, 42 ref.

Descriptors: \*Gas chromatography, \*Urine, Water analysis, Separation techniques, \*Chemical analysis.  
Identifiers: \*Selenium, \*Blood, Detection limits, Chemical interference, Chemical recovery, Sensitivity, Reproducibility, Biological samples, Sample preparation, Electron capture gas chromatography.

Samples to be analyzed for selenium are prepared by reacting selenium (IV) with 2,3-diaminonaphthalene at pH 2 to form the well established complex, which is extracted into hexane. An aliquot of the hexane layer is analyzed gas chromatographically with an electron-capture detector. As little as 5 times 10 to the minus 10 g of selenium could be detected; 0.01 microgram of selenium could be determined in a sample by extracting into 0.1 ml of hexane and injecting a 5-microliter aliquot of the extract. The method was applied to the determination of physiological amounts of selenium in human blood and urine. Averages of 0.38 p.p.m. and 0.007 p.p.m. selenium were found in blood and urine, respectively. River water samples were also analyzed. Complete analysis time for a sample is less than 3 h, including time for digestion of the sample and 2 h for formation of the complex. (Little-Battelle)  
W74-00041

**THE RATE OF LOSS OF MERCURY FROM AQUEOUS SOLUTION WHEN STORED IN VARIOUS CONTAINERS,**  
Idaho Univ., Moscow. Dept. of Chemistry.  
For primary bibliographic entry see Field 05A.  
W74-00043

**DETERMINATION OF SOME RARE-EARTH ELEMENTS BY PLASMA-JET EMISSION SPECTROMETRY,**  
Kitami Inst. of Tech. (Japan).  
I. Atsuya, and H. Goto.  
Analytica Chimica Acta, Vol 65, No 2, p 303-309, July 1973. 6 fig, 3 tab, 14 ref.

Descriptors: \*Pollutant identification, \*Aqueous solutions, \*Chemical analysis, Methodology, \*Spectrophotometry.  
Identifiers: Magnetic field, \*Rare earth elements, \*Plasma-jet emission spectrometry, Spectral analysis, Detection limits, Lanthanum, Yttrium, Accuracy, Gadolinium, Monazite, Precision, Scandium, Praseodymium, Neodymium, Samarium, Cerium.

The effects of a magnetic field on spectral intensities in plasma-jet spectrometry were examined, and detection limits for rare-earth elements were calculated. Plasma-jet emission spectrometry was applied to the determination of lanthanum, yttrium and gadolinium in a monazite sample from which thorium had been separated. A standard addition method was used in order to improve accuracy, and the internal standard and background compensation method was applied to measurements of spectral line intensities to achieve good precision. The coefficient of variation was 1.51 percent for 50 micrograms La/ml. (Holoman-Battelle)  
W74-00044

**SAMPLING THE EDIBLE MUSCLE OF THE SWORDFISH (XIPHIAS GLADIUS) FOR TOTAL MERCURY ANALYSIS,**  
Fisheries Research Board of Canada, Halifax (Nova Scotia). Halifax Lab.  
For primary bibliographic entry see Field 05A.  
W74-00052

**SEPARATION OF WATER FROM BIOLOGICAL AND ENVIRONMENTAL SAMPLES FOR TRITIUM ANALYSIS,**  
National Environmental Research Center, Las Vegas, Nev.  
For primary bibliographic entry see Field 05A.  
W74-00053

**A MODEL FOR CHEMICAL EXCHANGE IN THE BASALT-SEAWATER SYSTEM OF OCEANIC LAYER II,**  
Oregon State Univ., Corvallis. School of Oceanography.  
R. A. Hart.  
Canadian Journal of Earth Sciences, Vol 10, No 6, p 799-816, June 1973. 7 fig, 6 tab, 51 ref. NSF Grants GA-135 16, GA-27548, GA-35406.

Descriptors: \*Weathering, \*Water chemistry, \*Sea water, \*Basalts, Leaching, Potassium, Magnesium, Sodium, Silica, Calcium, Iron, Manganese, Chemical reactions, Geochemistry, Oceanography.

The upper 2-3 km of oceanic layer II is a zone of chemical reaction between seawater and the oceanic crust as it moves away from the midocean ridges. The principal alteration products resulting from the action of seawater on primary basalts are K-rich smectite formed during weathering of basalt, chlorite formed during retrograde metamorphism, and albite-actinolite formed during primary greenschist metamorphism at the ridge crest. These three processes in combination extract most of the stream input of K, Mg, and Na, and add SiO<sub>2</sub>, Ca, Fe, and Mn to the ocean systems in amounts comparable to stream input. The steady-state reactions of basalt with interstitial seawater to produce alteration minerals exercise a strong influence in the chemistry of seawater and release energy in amounts sufficient to form a portion of normal heat flow measured on the ocean floor. (Knapp-USGS)  
W74-00067

## WATER CYCLE—Field 02

### Chemical Processes—Group 2K

**HOLOCENE METEORIC DOLOMITIZATION OF PLEISTOCENE LIMESTONES, NORTH JAMAICA,**  
Texas Univ., Austin. Dept. of Geological Sciences.  
For primary bibliographic entry see Field 02J.  
W74-00101

**EFFECT OF COMPACTION ON CHEMISTRY OF SOLUTIONS EXPelled FROM MON-TOMORILLONITE CLAY SATURATED IN SEA WATER,**  
University of Southern California, Los Angeles. Dept. of Petroleum Engineering.  
For primary bibliographic entry see Field 02J.  
W74-00102

**CARBONATE CEMENTATION OF SOME PLEISTOCENE TEMPERATE MARINE SEDIMENTS,**  
Southampton Univ. (England). Dept. of Geology.  
For primary bibliographic entry see Field 02J.  
W74-00106

**THE DUSHANBE ARTESIAN BASIN AND ITS MINERAL AND THERMAL WATERS (DUSHANBINSKIY ARTEZIANSKIY BASSEYN I YEGO MINERAL'NYYE I TERMAL'NYYE VODY),**  
Akademija Nauk Tadzhikskoi SSR, Dushanbe. Institut Geologii.  
For primary bibliographic entry see Field 04B.  
W74-00117

**WATER CHEMISTRY OF ELICOTT CREEK, WESTERN NEW YORK,**  
Calspan Corp., Buffalo, N.Y.  
For primary bibliographic entry see Field 05A.  
W74-00166

**NITRATE CONTENT OF WELL WATER IN WEST-CENTRAL WISCONSIN,**  
Wisconsin Univ., River Falls.  
For primary bibliographic entry see Field 05B.  
W74-00246

**APPLICATION OF HIGH-SPEED LIQUID CHROMATOGRAPHY TO ORGANIC MICROANALYSIS. I. CONSTRUCTION OF A SIMPLE AND INEXPENSIVE APPARATUS,**  
City Univ. of New York.  
R. Stillman, and T. S. Ma.  
Mikrochimica Acta, No 4, p 491-506, 1973. 6 fig, 1 tab, 40 ref.

Descriptors: \*Laboratory equipment, Construction, \*Chemical analysis, \*Laboratory tests, \*Organic compounds, Operations, Evaluation, Costs, Instrumentation, Testing, Fabrication, Testing procedures, Separation techniques.  
Identifiers: \*Liquid chromatography, \*Trace levels, Detection limits, Reproducibility, Droppingmercury electrode, Sensitivity, Precision, Parathion, Methyl parathion.

Construction and operation details are given for a simple, inexpensive system used for liquid chromatography which is capable of separations whose speed and detection limits are comparable or superior to many commercial units. The system consists of a microdetector based on the principle of polarography with a dropping mercury electrode (DME), an electronic measuring circuit, a high pressure solvent pumping device, a sample injector, and highly efficient chromatographic columns. This system has been tested using parathion and methyl parathion. The minimum detectable quantity was about 0.01 microgram with a coefficient of variation of plus or minus 1.8 percent. In addition to compounds which are reducible at the DME at electrode potentials between -0.3 and -2.0 volts (the useful range for aqueous or aqueous-alcohol

solvent systems), other classes of compounds were detected, e.g., those exhibiting catalytic waves. All components of the system are readily available or easily fabricated, and the cost, exclusive of strip-chart recorder, is approximately \$200. (Holoman-Battelle)  
W74-00249

**PETROCHEMICAL ANALYTICAL PROBLEMS. II. GAS-LIQUID CHROMATOGRAPHIC-MASS SPECTROMETRIC INVESTIGATION OF INDUSTRIAL DODECYLBENZENES,**  
Magyar Tudomanyos Akademia, Veszprem. Research Group for Petrochemistry.  
For primary bibliographic entry see Field 05A.  
W74-00250

**VOLTAMMETRIC DETERMINATION OF NITRATE AND NITRITE IONS USING A ROTATING CADMIUM DISK ELECTRODE,**  
Iowa State Univ., Ames. Dept. of Chemistry.  
R. J. Davenport, and D. C. Johnson.  
Analytical Chemistry, Vol 45, No 11, p 1979-1980, September 1973. 3 fig, 24 ref.

Descriptors: \*Nitrates, \*Nitrites, \*Pollution identification, \*Methodology, Chemical analysis, Electrochemistry, Aqueous solutions, Ions.  
Identifiers: \*Rotating cadmium disk electrodes, \*Voltammetry, Rotating disc electrodes, Cadmium electrodes.

Cathodic current-potential curves are described which have been obtained with a rotating cadmium disk electrode (RCDE) in weakly acidic solutions of nitrate and nitrite ions. At low rotational velocities and bulk concentration, the cathodic currents are limited by convective-diffusional mass transport. Based on the reported results it is thought that rapid procedures for the accurate determination of nitrate and nitrite ions in aqueous solutions can be developed based on voltammetry with cadmium electrodes. Many species are expected to interfere in the determination including oxygen and transition metal cations which can be reduced at the electrode and separations are required. (Holoman-Battelle)  
W74-00251

**SILICA GEL AS AN INSOLUBLE CARRIER FOR THE PREPARATION OF SELECTIVE CHROMATOGRAPHIC ADSORBENTS - THE PREPARATION OF 8-HYDROXYQUINOLINE SUBSTITUTED SILICA GEL FOR THE CHELATION CHROMATOGRAPHY OF SOME TRACE METALS,**  
Rothamsted Experimental Station, Harpenden (England). Biochemistry Dept.

J. M. Hill.  
Journal of Chromatography, Vol 76, No 2, p 455-458, February 28, 1973. 14 ref.

Descriptors: \*Trace elements, Copper, Adsorption, Manganese, Zinc, Heavy metals.  
Identifiers: \*Chelation chromatography, \*8-Hydroxyquinoline, \*Aminopropyl silica gel, Adsorbents, 3-Aminopropyl triethoxy silane, Diazotization, Sample preparation.

Aminopropyl silica gel made by treating chromatographic grades of silica gel with 3-aminopropyl triethoxy silane, is reacted with p-nitrobenzoyl chloride and the -NO<sub>2</sub> group reduced to -NH<sub>2</sub> with sodium dithionite. Diazotization and reaction with 8-hydroxyquinoline produces a dark red silica gel derivative which can be used for the removal, concentration and separation of trace amounts of copper and other biologically important trace-metal cations from solutions of high ionic strength. The preparation of other selective adsorbents with different reactive groups is discussed. (Holoman-Battelle)  
W74-00252

**GAS-LIQUID CHROMATOGRAPHY-MASS SPECTROMETRY OF ORGANOMERCURY COMPOUNDS,**  
Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.  
For primary bibliographic entry see Field 05A.  
W74-00253

**THIN-LAYER CHROMATOGRAPHY AND ENZYME INHIBITION TECHNIQUES. INTRODUCTION,**  
Department of National Health and Welfare, Ottawa (Ontario). Health Protection Branch.  
For primary bibliographic entry see Field 05A.  
W74-00254

**ULTRATRACE ANALYSIS (BELOW P.P.B.) BY COUPLING CENTRIPETAL THIN-LAYER CHROMATOGRAPHY AND GAS CHROMATOGRAPHY,**  
Ceskoslovenska Akademie Ved, Brno. Ustav Instrumetalni Analyticke Chemie.  
For primary bibliographic entry see Field 05A.  
W74-00255

**THE USE OF PRESSURE-ASSISTED LIQUID CHROMATOGRAPHY IN THE SEPARATION OF POLYNUCLEAR HYDROCARBONS,**  
Metropolitan Police Forensic Lab., London (England).  
For primary bibliographic entry see Field 05A.  
W74-00256

**CADMIUM CONCENTRATIONS IN SOME FISH SPECIES FROM A COASTAL AREA IN SOUTHERN NORWAY,**  
Norges Veterinarhoegskole, Oslo. Dept. of Biochemistry.  
For primary bibliographic entry see Field 05A.  
W74-00257

**COMPOSITIONAL STUDIES OF A HIGH-BOILING 370-535 C DISTILLATE FROM PRUDHOE BAY, ALASKA, CRUDE OIL,**  
Bureau of Mines, Bartlesville, Okla. Bartlesville Energy Research Center.  
For primary bibliographic entry see Field 05A.  
W74-00258

**ADSORPTION OF TRACES OF INSECTICIDES FROM WATER ON POLYETHYLENE, (ADSORPTION VON SPUREN VON INSECTICIDEN AUS WASSER AN POLYATHYLEN),**  
Mainz Univ. (West Germany).  
For primary bibliographic entry see Field 05A.  
W74-00259

**A SYSTEM FOR POLYACRYLAMIDE GEL ELECTROPHORESIS OF HUMIC ACIDS, (EIN SYSTEM ZUR POLYACRYLAMIDELEK-TROPHORESE VON HUMINSÄUREN),**  
Medizinische Akademie Erfurt (East Germany). Institut fuer Medizinische Mikrobiologie.  
For primary bibliographic entry see Field 05A.  
W74-00260

**A STUDY OF THE VARIATION WITH PH OF THE SOLUBILITY AND STABILITY OF SOME METAL IONS AT LOW CONCENTRATIONS IN AQUEOUS SOLUTION. PART II,**  
Imperial Chemical Industries Ltd., Northwich (England). Winnington Lab.  
For primary bibliographic entry see Field 05A.  
W74-00261

**ON THE QUANTITATIVE DETERMINATION OF FREE CARBON DIOXIDE IN NATURAL WATERS, (ZUR QUANTITATIVEN BESTIM-**

## Field 02—WATER CYCLE

### Group 2K—Chemical Processes

MUNG DER FREIEN KOHLENSAURE IN NATURLICHEN WASSERN,  
J. Kegel.  
Zeitschrift fur Analytische Chemie, Vol 265, No 4, p 253-256, July 12, 1973. 4 ref.

Descriptors: \*Carbon dioxide, \*Theoretical analysis, Methodology, Gases, Chemical analysis, \*Water analysis, Estimating, Pollutant identification.

Identifiers: \*Quantitative analysis, \*Natural waters, Errors.

The theoretical examination of errors, undertaken by Hasselbarth (1965) on a new method to determine free carbon dioxide in water is investigated and it is found that he had employed wrong bases and arrived at misleading results. In his practical work, he had not considered all the possibilities of the method, which explains a number of differences. Therefore, the practical application of the method is described in detail. (Holoman-Battelle)  
W74-00263

THE DETERMINATION OF CHROMIUM IN HUMAN URINE BY GAS CHROMATOGRAPHY USING A FLAME PHOTOMETRIC DETECTOR WITH A 425, 4 NM FILTER,  
Environmental Protection Agency, Perrine, Fla.  
Perrine Primate Lab.  
For primary bibliographic entry see Field 05A.  
W74-00270

COUPLING OF HIGH SPEED PLASMA CHROMATOGRAPHY WITH GAS CHROMATOGRAPHY,  
National Bureau of Standards, Washington, D.C.  
Analytical Chemistry Div.  
S. P. Cram, and S. N. Chesler.

Descriptors: Methodology, \*Chemical analysis, Organic compounds, Effluents, \*Gas chromatography, Flow rates, Gases, \*Chromatography.  
Identifiers: \*GC-Plasma chromatography, Sensitivity, GC-Mass spectrometry, Signal-noise ratios, Flame ionization detectors.

A gas chromatography has been applied to a new rapid scan (20 msec) plasma chromatography without the use of a molecular separator. The sensitivity, noise, and signal-to-noise ratio for Freons analyzed on the plasma chromatography were found to be relatively insensitive to changes in the plasma chromatography carrier and drift gas flow rates, and a unique mass calibration curve for the E-series Freons is reported. The sensitivity of the plasma chromatograph and GC FIDs are compared for Freons and the utility of the plasma chromatography in identifying GC effluents and peak fractionation is reported. A comparison is made between gas chromatography/plasma chromatography and GC/MS. (Holoman-Battelle)  
W74-00271

AN ON-LINE SPECTROPHOTOMETER FOR COLLECTION OF MANIPULATION OF ABSORBANCE SPECTRA,  
Georgia Univ., Athens. Dept. of Biochemistry.  
For primary bibliographic entry see Field 07C.  
W74-00272

MICRODETECTION OF NITRATE WITH MALACHITE GREEN OR CONGO RED,  
V.S. Sanatan Dharma Coll., Kanpur (India). Dept. of Chemistry.  
G. S. Johar, and G. D. Tiwari.  
Zeitschrift fur Analytische Chemie, Vol 265, No 1, p 32, May 25, 1973.

Descriptors: \*Nitrites, \*Pollutant identification, Chemical analysis, Aqueous solutions, Iodides, Color reactions.

Identifiers: \*Trace levels, \*Congo Red, \*Malachite Green, Detection limits, Sensitivity, Chemical interferences, Azides, Chromogenic reagents.

Two procedures are outlined for a rapid and sensitive detection of minute quantities of nitrate. One procedure employs Malachite Green as the color-developing reagent with a detection limit of 75 micrograms nitrite per 0.25 ml. The other procedure uses Congo Red; the detection limit is 550 micrograms per 0.5 ml. Common anions and cations do not interfere in the tests. The only interference is caused by iodide and by azide in large amounts. (Holoman-Battelle)  
W74-00273

A FLUOROMETRIC METHOD FOR THE DETERMINATION OF NITRILOTRIACETIC ACID,  
Missouri Univ., Kansas City. Dept. of Chemistry.  
For primary bibliographic entry see Field 05A.  
W74-00274

DIRECT DETERMINATION OF BISMUTH AND ANTIMONY IN SEA WATER BY ANODIC STRIPPING VOLTAMMETRY,  
Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.  
T. R. Gilbert, and D. N. Hume.  
Analytica Chimica Acta, Vol 65, No 2, p 451-459, July 1973. 4 fig, 2 tab, 20 ref.

Descriptors: \*Sea water, \*Chemical analysis, Methodology, \*Pollutant identification, Water analysis, Electrochemistry, Water sampling, Water storage, Copper, Plastics, Metals.

Identifiers: \*Bismuth, \*Antimony, \*Anodic stripping voltammetry, Graphite electrodes, Sample preparation, Detection limits, Chemical loss, Silver, Chemical interference.

A method based on anodic stripping voltammetry at the mercury-coated graphite electrode has been developed for the direct determination of bismuth and antimony at their natural levels in seawater. Bismuth plated at -0.4 V from seawater made 1 M in hydrochloric acid gives a stripping peak proportional to concentration at -0.2 V without interference from antimony or other metals normally present. Antimony may be plated from seawater made 4 M in hydrochloric acid and gives a stripping peak at -0.2 V proportional to the sum of bismuth and antimony. By use of the standard addition technique, satisfactory results were obtained for seawater samples with concentration ranges of 0.02-0.09 microgram/kg for bismuth and 0.2-0.5 microgram/kg for antimony. (Holoman-Battelle)  
W74-00275

IMPROVED APPARATUS FOR DETERMINATION OF MERCURY BY FLAMELESS ATOMIC ABSORPTION,  
New England Aquarium, Boston, Mass.  
For primary bibliographic entry see Field 05A.  
W74-00276

DISPERSION AND TRANSPORT OF RHODAMINE B DYE AND METHOXYCHLOR IN RUNNING WATER: A PRELIMINARY STUDY,  
Queen's Univ., Kingston (Ontario). Dept. of Biology.  
For primary bibliographic entry see Field 05B.  
W74-00279

MESITYL OXIDE AS AN EXTRACTING AGENT FOR BERYLLIUM,  
Indian Inst. of Tech., Bombay. Dept. of Chemistry.  
P. V. Dhond, and S. M. Khopkar.

Analytical Chemistry, Vol 45, No 11, p 1937-1938, September 1973. 2 tab, 9 ref.

Descriptors: \*Separation techniques, \*Beryllium, \*Aqueous solutions, Metals, Chemical analysis.  
Identifiers: Chemical interference, \*Mesityl oxide, Sample preparation, Chemical recovery.

Beryllium nitrate was dissolved in distilled water to investigate the usefulness of mesityl oxide (4-methyl-3-pentene-one) as an extracting agent. The procedure involved adding hydrochloric acid and potassium thiocyanate to an aliquot of solution containing 20 micrograms Be, transferring the aqueous phase to a separatory funnel, and extracting with mesityl oxide for 3 minutes. After the two layers separate, Be is stripped off by shaking once with distilled water. Sodium acetate is added to the aqueous phase, the pH adjusted, alumon is added, the solution allowed to stand for 20 minutes, and the absorbance measured at 530 nm. The method is simple, sensitive, and selective, and applicable at microgram concentrations of Be. Common inorganic and organic ions were well tolerated. Recovery of Be was 99.5 percent plus or minus 0.5 percent. (Little-Battelle)  
W74-00280

IMPROVEMENTS IN THE MANGANESE DIOXIDE COLLECTION OF TRACE LEAD AND BISMUTH IN NICKEL,  
International Nickel Co. of Canada Ltd., Sheridan Park (Ontario). J. Roy Gordon Research Lab.  
St. J. H. Blakeley, A. Manson, and V. J. Zatka.  
Analytical Chemistry, Vol 45, No 11, p 1941-1943, September 1973. 5 tab, 3 ref.

Descriptors: \*Separation techniques, \*Lead, \*Nickel, Hydrogen ion concentration, Heavy metals, Aqueous solutions, Chemical precipitation.

Identifiers: Sample preparation, Coprecipitation, \*Bismuth, Atomic absorption spectrophotometry, Chemical recovery, Detection limits, Accuracy, Reproducibility, \*Trace levels.

Investigation of the method of using manganese dioxide for coprecipitating microgram quantities of lead and bismuth in nickel prior to atomic absorption analysis showed that lead recoveries were low and not reproducible. Using aqueous solutions of the metals dissolved in acid, it was found that formation of manganese dioxide in a boiling solution, as used in the method, results in a precipitate which has its collecting power for lead substantially reduced by the high ionic strength of the solution due to the large excess of nickel ions. By raising the pH to 4.5 and by performing the manganese oxidation in the cold solution, the extent of lead collection increased to 94-99 percent in a single precipitation. However, for the highest accuracy, a second precipitation is recommended for complete collection of lead. The working range of the method is 5-120 micrograms each of lead and bismuth. The precision, expressed as relative standard deviation, is 0.03 microgram lead and 0.05 microgram bismuth. (Little-Battelle)  
W74-00281

ANALYSIS OF EXPLOSIVES IN SEA WATER AND IN OCEAN FLOOR SEDIMENT AND FAUNA,  
Naval Ordnance Lab., White Oak, Md.  
For primary bibliographic entry see Field 05A.  
W74-00285

BIS-AROYLHYDRAZONES OF ALPHA-DIKETONES AS REAGENTS FOR COLORIMETRIC AND FLUORIMETRIC DETERMINATIONS OF CALCIUM, CADMIUM AND OTHER CATIONS,  
Greenlane Hospital, Auckland (New Zealand). Pathology Dept.  
M. Lever.

## WATER CYCLE—Field 02

### Chemical Processes—Group 2K

*Analystica Chimica Acta*, Vol 65, No 2, p 311-318, July 1973. 3 fig, 3 tab, 3 ref.

**Descriptors:** Pollutant identification, \*Color reactions, \*Cations, \*Fluorometry, \*Colorimetry, \*Chemical analysis, Aqueous solutions, Selectivity, Chemical reactions, Zinc, \*Calcium, \*Cadmium, Fluorescence, Sulfides, Magnesium, Strontium, Aluminum, Copper, Manganese, Alkaline earth metals, Heavy metals, Organic compounds, Methodology.

**Identifiers:** \*Chromogenic reagents, \*Bis-aryloylhydrazones, Complexing agents, Metal chelates, Cyanides, Chemical interference, Thiols, Barium, Tin, Citrates, Fluorescent spectra, Molar absorptivity, Rare earth elements.

An evaluation has been made of the potential of the bis (4-hydroxybenzoylhydrazones) of glyoxal, methylglyoxal, and dimethylglyoxal as reagents for the colorimetric and fluorometric determination of metallic cations. Bis-aryloylhydrazone solutions in 10 mM aqueous NaOH were used to study the effect of cations. The effects of using different bases and of varying their concentrations were investigated. Reagents such as cyanide (20 mM) and citrate (0.2 M) were added to alter the selectivity of the color reactions. Fluorescence measurements were also made in ethanol and other solvents. The bis (4-hydroxybenzoylhydrazones) of glyoxal, methylglyoxal and dimethylglyoxal form colored chelates with Ca (2 plus), Cd (2 plus), La (3 plus), a Bi (III) species and other cations. The glyoxal derivative shows more selective reactions, and highly selective assays are possible for calcium and cadmium in the presence of cyanide and citrate, respectively; Beer's law was obeyed in the range 0-50 mM for both cations. The chelates were also fluorescent, the reaction for lanthanum being particularly sensitive. The formation of this type of chelate is a general property of the bis-aryloylhydrazones of alpha-diketones. (Holoman-Battelle)

W74-00286

#### THE SOLVENT EXTRACTION OF THE TERNARY COMPLEXES OF IRON (II)-RHODAMINE B WITH VARIOUS NITROSOPHENOLS. DETERMINATION OF IRON IN WATERS,

Okayama Univ. (Japan). Dept. of Chemistry.

T. Korenaga, S. Motomizu, and K. Toei.

*Analystica Chimica Acta*, Vol 65, No 2, p 335-346, July 1973. 7 fig, 7 tab, 18 ref.

**Descriptors:** \*Iron, \*Water analysis, \*Solvent extractions, \*Pollutant identification, Separation techniques, Methodology, Chemical reactions, Potable water, Color reactions, Chelation, Hydrogen ion concentration, Chemical analysis, Sodium, Potassium, Magnesium, Calcium, Chlorides, Nitrates, Sulfates, Carbonates, Rivers, Heavy metals, Cations, Anions, Selectivity, Aqueous solutions.

**Identifiers:** \*Rhodamine B, Complexing agents, \*Nitrosophenols, \*Metal complexes, Absorbance, Chromogenic reagents, Natural waters, Chemical recovery, Sensitivity, Metal chelates, Benzene, Organic solvents, Nitrosonaphthols, Molar absorptivity, Ammonium, Chemical interference, Tiocyanates, Xylenol orange, Chrome azurol S, Pyrocatechol violet.

Twenty nitrosophenols and nitrosonaphthols were examined as reagents for ternary complex formation with iron (II) and rhodamine B. Only reagents containing electron-attracting substituents, such as chloro, bromo, and carboxyl substituents, were satisfactory, and of these, 2-nitroso-4-chlorophenol was best. The ternary complex contains 2-nitroso-4-chlorophenol, iron (II) and rhodamine B in the ratio 3:1:1, and can be readily extracted into benzene. The red extracted complex shows maximal absorbance at 558 nm with a molar absorptivity of 90,000. Beer's law is obeyed over the range 0-0.00001 M iron (II); the pH range for

extraction is 4.3-5.3, and the color is stable for at least 1 week. Interference studies with Na, K, Mg, Ca, ammonium, chloride, nitrate, sulfate, and carbonate ions showed that even 10-fold and 100-fold normal concentrations will not interfere with the ternary complex which can be quantitatively extracted into benzene. The application of the method to the determination of iron in potable and river waters is described. (Holoman-Battelle)

W74-00288

#### MULTELEMENT INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS OF BIOLOGICAL MATERIALS,

Cornell Univ., Ithaca, N.Y. Dept. of Chemistry. R. A. Nadkarni, and G. H. Morrison.

*Analytical Chemistry*, Vol 45, No 11, p 1957-1960, September 1973. 2 tab, 29 ref.

**Descriptors:** \*Pollutant identification, \*Trace elements, Heavy metals, Chemical analysis, Plant tissues, Radioactivity techniques, Methodology, Alkaline earth metals, Radioisotopes, Neutron activation analysis, Pollutants, Cobalt, Chromium, Copper, Iron, Manganese, Zinc, Molybdenum, Nickel, Sodium, Potassium, Magnesium, Calcium, Fluorine, Bromine, Phosphorus, Sulfur, Mercury, Beryllium, Lead, Cadmium, Aluminum, Chlorine, Strontium, Cesium, Arsenic radioisotopes, Cadmium radioisotopes, Chlorine radioisotopes, Cobalt radioisotopes, Iodine radioisotopes, Potassium radioisotopes, Strontium radioisotopes, Zinc radioisotopes.

**Identifiers:** \*Instrumental neutron activation analysis, \*Biological samples, \*Mulitelement analysis, Animal tissues, Accuracy, Rare earth elements, Biological materials, Liver, Selenium, Vanadium, Barium, Silver, Arsenic, Antimony, Lithium, Bismuth, Rubidium, Lanthanum, Lutetium, Ytterbium, Scandium, Europium, Detection limits, Orchard leaves.

An INAA method capable of determining up to 36 elements, including many of the essential and toxicological trace elements is described. Since no chemical processing is involved, volatile elements such as As, Br, Cl, Hg, Se, and Sb are not lost in the method. Also, no chemical yields need to be determined for each of the elements determined. The method uses a multielement biological standard during irradiation which is similar in matrix element composition to the samples analyzed. This minimizes differences in neutron self-shielding and absorption effects between the standard and samples, as well as eliminates the task of preparing a large number of synthetic standards. With regard to the capability of determining the essential elements in biological materials, the INAA method has successfully measured Co, Cr, Cu, Fe, Mn, Mo, Se, Zn, Ni, V, Na, K, Mg, and Ca. Because of adverse nuclear properties F, B, P, and S cannot be measured using thermal neutron activation analysis and gamma spectrometry. Iodine and Sn could not be measured in these samples because they are present below the detection limit of the method. Of the toxicological elements, Ba, Ni, Ag, Hg, As, Sb, and Br can be measured by this method. Li, Be, Pb, and Bi cannot be measured because of adverse nuclear properties, and Cd in these samples is below the detection limit. Finally, the INAA method can also determine Al, Rb, Cl, Sr, La, Lu, Yb, Sc, Cs, and Eu in biological samples. (Holoman-Battelle)

W74-00289

**DETECTION OF SALTS OF 2,4-D IN AQUEOUS SOLUTION BY LASER RAMAN SPECTROSCOPY,**  
Kentucky Univ., Lexington. Dept. of Electrical Engineering.  
For primary bibliographic entry see Field 05A.  
W74-00297

#### QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1968: PART 2. SOUTH ATLANTIC SLOPE AND EASTERN GULF OF MEXICO BASINS.

Geological Survey, Washington, D.C.

Available GPO, Washington, DC 20402 - Price \$2.35 postpaid or \$2.00 GPO Bookstore. Water-Supply Paper 2092, 1973. 373 p, 1 fig, 39 ref.

**Descriptors:** \*Water quality, \*Surface waters, \*Basic data collections, \*Chemical analysis, \*Southeast U.S., Water analysis, Chemical properties, Physical properties, Dissolved solids, Inorganic compounds, Nutrients, Coliforms, Trace elements, Water temperature, Discharge (Water), Sediment yield, River, Lakes, Reservoirs, Estuaries.

**Identifiers:** \*South Atlantic Slope Basins, \*Eastern Gulf of Mexico Basins.

Quality of surface waters are presented for the South Atlantic Slope and Eastern Gulf of Mexico Basins for the 1968 water year (Oct. 1967-Sept. 1968). The Geological Survey has published annual records of chemical quality, water temperature, and suspended sediment since 1941. The records are listed by drainage basins in a downstream direction along the main stream. The mineral con-

tions, Chemical precipitation, Radioactivity techniques, Calcium chloride, Chemical analysis, Solutes, Calcium hydroxide, Calcium carbonate, Calcium sulfate, Copper sulfate, Magnesium hydroxide, Sodium sulfate, Ammonia, Sodium chloride, Cations, Anions.

**Identifiers:** \*Solvent extraction systems, \*Acetone, Organic solvents, Chemical recovery, Metal chelates, Magnesium chloride, Sucrose.

Seventy-nine compounds have been investigated as possible salting-out agents for the separation of acetone from aqueous solutions and its use for solvent extraction of metal chelates. Saturated aqueous salt solutions were prepared from ACS reagent grade chemicals at room temperature and allowed to sit with intermittent agitation for at least 7 days at room temperature before experimentation. Reagent grade acetone was used and Karl Fischer titrations were used to determine the amount of water present in the acetone. Atomic absorption spectrophotometric and radioactivity techniques were used in determining the best salting-out agents. Three of the compounds, calcium chloride, magnesium chloride, and sucrose, were superior in that they were efficient salting-out agents, were not strong complexing agents, their pH could be readily adjusted, and they did not react with many commonly used chelating agents. The solvent extraction of the cobalt-1-pyridinecarboxylate chelate using calcium chloride as the salting-out agent has been demonstrated using radiotracers. Acetone separated from saturated calcium chloride solution contained 0.321 plus or minus 0.011 percent water (v/v) and 212 ppm salt (w/v) at equilibrium. Equilibrium was achieved in 2 hr, but could be reached rapidly by centrifuging for 3 min. (Holoman-Battelle)

W74-00290

## Field 02—WATER CYCLE

### Group 2K—Chemical Processes

stituents and physical properties of natural waters reported in the tables of analyses include those that have a practical bearing on water use. The results of analyses generally include silica, iron, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, fluoride, nitrate, boron, pH, dissolved solids, and specific conductance. Aluminum, manganese, color, acidity, dissolved oxygen, and other dissolved constituents and physical properties (including temperature and sediment yield) are reported for certain streams. Microbiologic (coliforms) and organic components (pesticides, total organic carbon) and minor elements (arsenic, cobalt, cadmium, copper, lead, mercury, nickel, strontium, zinc, etc) are determined occasionally for some streams in connection with specific problems and the results are reported. The source and significance of the different constituents and properties of natural waters are discussed. (Woodard-USGS)

W74-00303

#### SILICA-CARBONATE ALTERATION OF SERPENTINE: WALL ROCK ALTERATION IN MERCURY DEPOSITS OF THE CALIFORNIA COAST RANGES,

Geological Survey, Menlo Park, Calif.

I. Barnes, J. R. O'Neil, J. B. Rapp, and D. E.

White.

Economic Geology, Vol 68, No 3, p 388-398, May 1973. 2 fig, 2 tab, 29 ref.

Descriptors: \*Chemical reactions, \*Geochemistry, \*Water chemistry, \*Carbon dioxide, \*California, Coasts, Geology, Rocks, Groundwater, Silica, Carbonate rocks, Mercury, Analytical techniques, Rock properties, Geologic formations.

Identifiers: \*Serpentine alteration.

Chemical, isotopic, and thermodynamic properties of CO<sub>2</sub>-rich groundwaters have been measured in the central California Coast Ranges. The acidic CO<sub>2</sub>-rich waters react with serpentine to form silica-carbonate rock, the host rock of many mercury deposits in the Coast Range of California. In part the waters are of a metamorphic origin and in part the waters are locally derived meteoric waters. The CO<sub>2</sub> is entirely derived from metamorphic reactions at depth. Depending on the relative importance of several reactions, the relative abundances of silica and carbonate minerals vary in the silica-carbonate rock. If the CO<sub>2</sub>-rich fluids react directly with peridotite or dunite, massive magnesite deposits may form. (Woodard-USGS)

W74-00304

#### ORGANIC POLLUTANT IDENTIFICATION UTILIZING MASS SPECTROMETRY,

Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.

For primary bibliographic entry see Field 05A.

W74-00309

#### PREPARATIVE FREE-FLOW ELECTROPHORESIS AS A METHOD OF FRACTIONATION OF NATURAL ORGANIC MATERIALS,

Geological Survey, Washington, D.C.

J. A. Leenheer, and R. L. Malcolm.

Available from GPO, Washington, D.C. 20402

Price \$0.35. Geological Survey Water-Supply Paper 1817-D, 1973. 14 p, 9 ref.

Descriptors: \*Electrochemistry, \*Organic compounds, \*Electrophoresis, Separation techniques, Surface waters, Groundwater, Soil water, Electrodialysis, Ion transport, Water quality control.

Identifiers: \*Fractionation.

Preparative free-flow electrophoresis was found to be an efficient method of conducting large-scale fractionations of the natural organic polyelectrolytes occurring in many surface waters and

soils. The method of free-flow electrophoresis obviates the problem of adsorption upon a supporting medium and permits the use of high potential gradients and currents because of an efficient cooling system. Separations were monitored by determining organic carbon concentration with a dissolved carbon analyzer, and color was measured by absorbance at 400 nanometers. Organic materials from waters and soils were purified by filtration, hydrogen exchange, and dialysis and were concentrated by freeze drying or freeze concentration. In electrophoretic fractionations of natural organic materials typically found in surface waters and soils, color was found to increase with the charge of the fraction. (Woodard-USGS)

W74-00321

#### SIGMA-INDUCTIVE MODEL VS. FIELD MODEL. OBSERVATION OF A REVERSED ATTENUATION EFFECT,

Georgia Inst. of Tech., Atlanta. School of Chemistry.

C. L. Liotta, W. F. Fisher, E. L. Slichtom, and C.

L. Harris.

Journal of the American Chemical Society, Vol 94, p 2129-2130, 1972. 1 fig, 2 tab, 11 ref. OWRR B-049-GA (2), NSF Grant No. GP 14437.

Descriptors: \*Water chemistry, \*Aqueous solutions, \*Synthesis, \*Chemical reactions, Analytical techniques, Model studies, Operations research, Organic compounds, Hydrogenation, Hydrolysis, Organic acids, Correlation analysis, Evaluation. Identifiers: Organic base values, Reversed attenuation effect.

Many attempts have been made to distinguish between and evaluate the relative importance of the sigma-inductive and field models of reversed attenuation effects. Perhaps the strongest qualitative evidence for the operation of field effect is the observation of the angular dependence of substituent effects. Several studies involving direct comparison of rigid model systems provide more quantitative evidence for the superiority of the field model in describing the propagation of non-conjugative substituent effects. The first unambiguous example is reported of a reversed attenuation effect—an observation which questions the very foundation of the sigma-inductive model. The field model adequately accounts the experimental facts. Some 5- and 6-hydroxybicyclo-(2.2.2)octane-2-carboxylic acids were synthesized and their pKa values determined in 50% (by weight) aqueous ethanol at 25 deg. The data are summarized. In each of these cases both the substituent and the reaction center are, to a good approximation, in the same steric environment. This implies that the steric approach of solvent molecules to these centers is approximately the same in the three cases. (See also W73-00324)

W74-00323

#### MECHANISM OF TRANSMISSION OF NON-COCONJUGATIVE SUBSTITUENT EFFECTS. IV. ANALYSIS OF THE DISSOCIATION CONSTANTS OF 6-SUBSTITUTED SPIRO (3.3) HEPATANE-2-CARBOXYLIC ACIDS,

Georgia Inst. of Tech., Atlanta. School of Chemistry.

C. L. Liotta, W. F. Fisher, G. H. Greene, Jr., and

B. L. Joyner.

Journal of the American Chemical Society, Vol 94, p 4891-4897, 1972. 6 fig, 6 tab. OWRR B-049-GA (3), NSF Grant GP 14437.

Descriptors: \*Water chemistry, \*Aqueous solutions, \*Chemical reactions, \*Electrochemistry, Polarity, Acids, Alkalies (Bases), Analytical techniques, Organic acids, Temperature, Model studies, Correlation analysis, Evaluation.

Identifiers: Dissociation constants.

The pKa's of eight 6-substituted spiro (3.3) heptane-2-carboxylic acids in 50% (by weight) aque-

ous ethanol at 25 C are presented. Excellent correlation is obtained between the experimental data and sigma-inductive parameters, whereas only a fair correlation is obtained using the Dewar-Grindale F parameters. The data are also analyzed by means of the Tanford modification of the Kirkwood-Westheimer cavity model. Excellent agreement between calculated and experimental results is obtained with the spherical cavity model as well as with Stock's modification of this electrostatic model. An analysis is presented which demonstrates that hydrogen and methyl substituents do not exhibit anomalous behavior when compared to more polar substituents by means of the cavity models. Analysis of the limiting models for the propagation of nonconjugative substituent effects (sigma-inductive and field) suggests that the field model is more reliable in explaining the data. (See also W73-00323) (Woodard-USGS)

W74-00324

#### WATER IN THE SAN LUIS VALLEY, SOUTH-CENTRAL COLORADO,

Geological Survey, Denver, Colo.

For primary bibliographic entry see Field 02A.

W74-00331

#### EFFECT OF SALINITY ON THE OPTICAL EXTINCTION OF SEA ICE AT 6328A,

Cold Regions Research and Engineering Lab., Hanover, N.H.

For primary bibliographic entry see Field 02C.

W74-00333

#### SOLUBLE PARTICULATES IN ICE FROM SITE 2, GREENLAND,

Nevada Univ., Desert Research Inst., Reno.

For primary bibliographic entry see Field 02C.

W74-00334

#### AVAILABILITY OF WATER FROM LIMESTONE AND DOLOMITE AQUIFERS IN SOUTHWEST OHIO AND THE RELATION OF WATER QUALITY TO THE REGIONAL FLOW SYSTEM,

Geological Survey, Columbus, Ohio.

For primary bibliographic entry see Field 04B.

W74-00336

#### METHODS OF KARST INVESTIGATION (METODY IZUCHENIYA KARSTA),

A. G. Chikishev.

Izdatel'stvo Moskovskogo Gosudarstvennogo Universiteta, 1973. 92 p.

Descriptors: \*Karst, \*Investigations, \*Analytical techniques, Geology, Geomorphology, Topography, Hydrology, Biology, Aerial photography.

Identifiers: USSR, Karst landforms, Karst processes, Geodesy, Cartography.

Methods commonly employed in the study of karst are analyzed, compared, and evaluated, and new methods or methods borrowed from allied sciences and adapted to karst studies are proposed. These include geological, geomorphological, topographic, hydrological, biological, quantitative, aerial photographic, cartographic, and landscape-indicator methods. (Josephson-USGS)

W74-00345

#### CALCIUM CARBONATE CEMENTATION OF ALLUVIAL FANS IN SOUTHERN NEVADA,

Cincinnati Univ., Ohio. Dept. of Geology.

L. H. Lattman.

Geological Society of America Bulletin, Vol 84, No 9, p 3013-3028, September 1973. 10 fig, 1 tab, 15 ref.

## WATER CYCLE—Field 02

### Estuaries—Group 2L

Descriptors: \*Alluvial fans, \*Carbonates, \*Soil formation, \*Calcium carbonate, \*Nevada, Diagenesis, Alluvium, Geomorphology, Chemical precipitation, Mineralogy.

Several types of calcium carbonate cement occur on alluvial fans in southern Nevada. Secondary calcium carbonate deposits of pedogenic origin begin as coatings on pebble-size and larger clasts, and progress through calcic horizons to petrocyclic horizons and laminar layers. Nonpedogenic deposits include some laminar layers, gully-bed cementation, and case hardening. The extent and development of cementation are greatest on fans composed of carbonate and basic igneous rock detritus, less on fans built of siliceous sedimentary detritus, and least on fans composed of acid igneous rock material. In a single fan, the best-developed cementation is in the poorly sorted layers of alluvium containing more than 25% material coarser than pebbles. The major source of calcium carbonate deposited on noncarbonate fans is apparently wind-blown silt and sand and, as a result, fans of noncarbonate detritus are best cemented downwind of playas high in carbonates. (Knapp-USGS)  
W74-00349

**GEOLOGY AND GROUND-WATER RESOURCES OF RUSH COUNTY, CENTRAL KANSAS,**  
Geological Survey, Lawrence, Kans.  
For primary bibliographic entry see Field 04B.  
W74-00352

**WATER RESOURCES SUMMARY, ISLAND OF HAWAII,**  
Geological Survey, Honolulu, Hawaii.  
For primary bibliographic entry see Field 02E.  
W74-00355

**A RECONNAISSANCE OF THE WATER RESOURCES IN THE PAHSIMEROI RIVER BASIN, IDAHO,**  
Geological Survey, Boise, Idaho.  
For primary bibliographic entry see Field 02E.  
W74-00356

**SOME ASPECTS OF THE HYDRODYNAMIC DISPERSION OF SOLUTES IN POROUS MATERIALS,**  
Rothamsted Experimental Station, Harpenden (England).  
For primary bibliographic entry see Field 02G.  
W74-00360

**DISPERSION-AFFECTED TRANSPORT OF REACTING SOLUTES IN SATURATED POROUS MEDIA: GALERKIN METHOD APPLIED TO EQUILIBRIUM-CONTROLLED EXCHANGE IN UNIDIRECTIONAL STEADY WATER FLOW,**  
Geological Survey, Menlo Park, Calif.  
For primary bibliographic entry see Field 05B.  
W74-00364

**EFFECT OF INSOLUBLE GRAINS ON LEACHATE FROM POROUS BEDS,**  
Syracuse Univ., N. Y. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 05B.  
W74-00379

**A COMPARISON OF A WET PRESSURE DIGESTION METHOD WITH OTHER COMMONLY USED WET AND DRY-ASHING METHODS,**  
Colorado Div. Wildlife, Fort Collins.  
For primary bibliographic entry see Field 05A.  
W74-00462

**DETERMINATION OF ORTHOPHOSPHATE,**  
Arizona Univ., Tucson. Coll. of Medicine.  
For primary bibliographic entry see Field 05A.  
W74-00464

**THE CHEMISTRY AND QUANTITATIVE UTILITY OF SODIUM COBALTINITRIDE IN THE DETERMINATION OF PHENOLS,**  
Iowa Univ., Iowa City. Coll. of Pharmacy.  
For primary bibliographic entry see Field 05A.  
W74-00465

**ENTHALP, A COMPUTER PROGRAM FOR THE CALCULATION OF AQUIFER CHEMISTRY IN HOT-WATER GEOTHERMAL SYSTEMS,**  
Geological Survey, Menlo Park, Calif. Geologic Div.  
For primary bibliographic entry see Field 02F.  
W74-00532

**RECONNAISSANCE OF THE WATER RESOURCES OF BEAVER COUNTY, OKLAHOMA,**  
Geological Survey, Washington, D.C.  
For primary bibliographic entry see Field 07C.  
W74-00534

**GEOHYDROLOGY OF DONIPHAN COUNTY, NORTHEASTERN KANSAS,**  
Geological Survey, Washington, D.C.  
For primary bibliographic entry see Field 07C.  
W74-00536

**WATER RESOURCES OF THE NISQUALLY INDIAN RESERVATION, WASHINGTON,**  
Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 04A.  
W74-00544

## 2L. Estuaries

**PROBABILITIES OF WAVE CHARACTERISTICS IN THE SURF ZONE,**  
Tetra Tech, Inc., Pasadena, Calif.  
For primary bibliographic entry see Field 02H.  
W74-00018

**TIDAL CURRENTS AND ZIG-ZAG SAND SHOALS IN A WIDE ESTUARY ENTRANCE,**  
Old Dominion Univ., Norfolk, Va. Inst. of Oceanography.  
John C. Ludwick.

Available from the National Technical Information Service as AD-755 735, \$3.00 in paper copy, \$1.45 in microfiche. Technical Report No. 7, January 1973. 112 p, 22 fig, 9 tab, 56 ref, 3 append. NOOO14-70-C-0083.

Descriptors: \*Estuaries, \*Sediment transport, Sand bars, \*Deposition (Sediments), Sedimentation, \*Coasts, \*Tidal effects.

Identifiers: \*Coastal processes, \*Tidal currents, Sand shoals, Chesapeake Bay, Ebb flow, Flood flow, \*Tidal flushing.

Fourteen 27-hour tidal current stations were occupied in the entrance to Chesapeake Bay in a 40-square mile area of subtidal sand banks and channels where the average water depth is 21 feet. Near the bottom at most stations, flood flow dominates over ebb flow in both peak speed and duration. Velocity profiles from bottom to surface are fitted by a parabolic-shaped velocity deficit law from which shear stress at the bed was estimated. With two exceptions, net transport of bed sediment is ebb-directed. Decrease in net sediment transport rate along the path of net motion requires deposition of sediment. Locations of deduced deposition correspond to shoals. Prominent indentations, or

sinuses, in the margins of shoals, are strongly dominated by net sediment transport towards the closed end of a channel. Zig-zag shoals extend from the north cape, three-fourths of the distance to the south across the entrance. This line of shoals is comprised of oppositely-opening sinuses, or parabolas, which are with distance to the south alternately ebb-dominated and flood-dominated. The shoals represent spit building action in the presence of strong reversing tidal currents. Other shoals in the entrance are due to subaqueous levee building marginal to main channels. Still other shoals in the entrance are constructed when a flood-dominated channel intersects the ebb-directed path of net sediment transport, the entrapped sediment then being flushed landward to form a secondary shoal when spreading of the flood current occurs. (Sinha-OEIS)  
W74-00021

**WAVE INDUCED CIRCULATION AND LONGSHORE CURRENT PATTERNS IN THE COASTAL ZONE,**  
Tetra Tech, Inc., Pasadena, Calif.  
E. K. Noda.

Available from the National Technical Information Service as AD-750 291, \$3.00 in paper copy, \$1.45 in microfiche. Report no. TETRAT-P-72-149-3, September 1972. 109 p, 23 fig, 15 tab, 11 ref. 2 append. ONR-NOOO14-69-C-0107.

Descriptors: \*Ocean currents, Mathematical models, \*Ocean waves, Computer programs, \*Coasts, \*Beaches, Hydrodynamics.  
Identifiers: Coastal zone, \*Coastal topography, \*Beach profiles, Bottom topography, Momentum flux, Surf zone, \*Beach processes, \*Near shore processes, \*Near shore circulation, Wave incidence.

A theoretical analysis is presented on the generation and stabilization of nearshore, wave-induced circulation and longshore current patterns produced by the interaction of the incoming waves and local bottom topography. This interaction results in a spacial variation of wave characteristics which produces the driving mechanism for nearshore circulation patterns. Both normal and oblique wave incidence are considered with the imposed beach profiles developed from an examination of prototype data. The analytical model results are compared to field measurements and yield optimistic results. (Sinha-OEIS)  
W74-00023

**A COMPUTER PROGRAM TO ESTIMATE THE COMBINED EFFECT OF REFRACTION AND DIFFRACTION OF WATER WAVES,**  
Texas A and M Univ., College Station. Coastal and Ocean Engineering Div.  
H. W. Worthington, and J. B. Herbich.

Available from the National Technical Information Service as PB-194 668, \$3.00 in paper copy, \$1.45 in microfiche. Sea Grant Publication TAMUS-70-219, August 1970. 57 p, 10 fig, 2 tab, 17 ref, 3 append. Grant: NSF-GH-59.

Descriptors: Harbors, \*Waves (Water), \*Computer programs, \*Breakwaters, \*Refraction (Water waves).

Identifiers: REDSEA, \*Coastal processes, \*Near shore processes, \*Diffraction (Water waves), Shoaling.

Phenomena are reviewed which generally affect water waves entering a harbor, and the traditional methods of calculating the effects of the 3 principal phenomena - refraction, diffraction and shoaling are discussed. The utility of harnessing the capability of the computer to make the required calculations is illustrated. A computer program is presented which estimates the effects of refraction and diffraction as they combine to change the direction and height of water waves. A unique feature of the program, referred to as

## Field 02—WATER CYCLE

### Group 2L—Estuaries

'REDSEA', is that it considers the degree of reflection from the breakwater in calculating the diffraction coefficients. The validity of the predicted results is established by comparing them to experimental data obtained in connection with this study as well as data from a similar study conducted previously. Applications of the program to design and analysis problems are discussed. (Sinha-OEIS)  
W74-00024

#### GRAVITATIONAL CIRCULATION IN STRAITS AND ESTUARIES,

Washington Univ., Seattle. Dept. of Oceanography.

D. V. Hansen, and M. Rattray, Jr.  
Journal of Marine Research, Vol 23, No 2, p 104-122, May 1965. 11 fig, 1 tab, 22 ref. NSF-GP-1101, GP-3549. NONR-477 (10), NONR-477 (37).

Descriptors: \*Estuaries, Salinity, Circulation, Ocean circulation, \*Straits, Density, Turbulence, Dispersion, Pollutants, Mixing, Tides, Currents (Water).

Identifiers: \*Boundary conditions, Similarity solutions, Flushing.

Solutions are presented of the basic differential equations for the central and inner regimes of estuaries; both forced and free convections are considered, and two-dimensional salinity distributions are derived from external parameters. A coupled set of partial differential equations and associated boundary conditions is written to describe circulation and salt-flux processes for estuaries in which turbulent mixing results primarily from tidal currents. Similarity solutions, motivated by characteristic salinity distributions observed in estuaries, are obtained for this set of equations and are compared with observational data. The circulation is separated into modes analogous to the barotropic, baroclinic, and Ekman modes of oceanic circulation. The salinity distribution, although coupled to the velocity distribution, is found to vary independently of it as well. The theoretical results are discussed in regard to: (i) correlation between the vertical variations of mean velocity and salinity, (ii) the role of this correlation in maintaining the steady-state salinity distribution in estuaries, and (iii) some implications for computations of flushing and dispersion of contaminants. (Sinha-OEIS)  
W74-00029

#### EFFECTS OF A NONRIGID, IMPERMEABLE BOTTOM OF PLANE SURFACE WAVES IN SHALLOW WATER,

Texas A and M Coll., College Station.  
H. G. Gade.  
Journal of Marine Research, Vol 16, No 2, p 61-82, 1958. 12 fig, 5 ref.

Descriptors: \*Shallow water, Mathematical models, Friction, Energy loss, Mud, Sediments, Waves (Water), Energy, Bottom sediments.  
Identifiers: \*Coastal processes, Nonrigid bottoms.

Mutual effects of progressive wave motion in shallow water and in underlying fluid sediments are discussed, with emphasis on modification of the surface wave. The mathematical model is a layer of inviscid fluid overlaying a viscous fluid of greater density and bounded by a horizontal rigid plane. Solutions for locally periodic, simple harmonic disturbances indicate that wave height decays exponentially with travelled distance. The rate of dissipation of energy in the lower layer is proportional to (a) the wave energy, (b) the ratio of amplitudes at the interface and the surface, and (c) the sine of an angle closely related to the phase difference between profiles at the free surface and the interface. Comparison is made between typical values of water decay due to dissipation in a fluid bottom and that due to friction loss over a rigid sand bottom. Even in a relatively thin layer of mud

the dissipation exceeds by far the energy loss due to bottom friction. (Sinha-OEIS)  
W74-00030

#### BIOLOGICAL AND CHEMICAL FEATURES OF TIDAL ESTUARIES,

Oregon State Univ., Corvallis.

H. F. Frolander.  
Journal Water Pollution control Federation, Vol 36, No 8, p 1037-1048, August 1964. 7 fig, 2 tab, 14 ref. NONR 1286 (10). NSF GP 622.

Descriptors: Estuaries, \*Spatial distribution, \*Tidal effects, Zooplankton, Salinity, \*Light penetration, Migration, \*Turbidity, Water temperature, \*Estuarine processes, Oregon, Rhode Island.

Identifiers: Yaquina Bay (Oregon), Narragansett Bay (Rhode Island).

Relationships between zooplankton populations and estuary characteristics are illustrated principally using data from two mid-latitude estuaries on the coasts of the United States; one is Yaquina Bay, Oregon, a landlocked estuary; the other is Narragansett Bay, Rhode Island, a relatively open-mouthed estuary. Physical and chemical factors, such as temperature and salinity, set limits of survival and reproduction but, within these limits, the time of day and the relation of the organisms to light, as well as the phase of the tide, will impose additional limits on organisms' spatial distribution. The horizontal translocation of zooplankton organisms is particularly great in long, narrow and shallow estuaries, especially in estuaries with a large tidal prism. Even the phase of the moon is important. It affects tides and resulting differences in speed of tidal currents; the resulting turbidity effects limit light penetration and, thus, change diurnal migration patterns. The light of the moon itself may influence the diurnal migrations and thus, the spatial distribution of species. (Sinha-OEIS)  
W74-00031

#### CHARACTERISTICS OF WAVE RECORDS IN THE COASTAL ZONE,

Army Coastal Engineering Research Center, Washington, D.C.

For primary bibliographic entry see Field 02H.  
W74-00033

#### COASTAL PROCESSES AND LONG RANGE PLANNING,

Scripps Institution of Oceanography, La Jolla, Calif.

B. M. Brush, and D. L. Inman.  
In: Marine Technology Society 8th Annual Conference Preprints, p 215-226, 1972. 6 fig, 12 ref. NOAA SG 2-35208.

Descriptors: Planning, Coasts, \*Sediment transport, Sediments, Harbors, Beaches, \*Shore protection, Coastal engineering, Management.

Identifiers: \*Coastal processes, Coastal energy, Tidal power, Crater sink, \*Beach stabilization, Sand ripples, Roughness elements, \*Environmental impact, \*Littoral processes, Circulation cells.

The topics of coastal management and coastal planning are more frequently in the public consciousness than heretofore. The recent decade has produced new insights into the physical processes of the coastal zone which are of value to policy making as well as to science. These developments now enable remedial methods to be undertaken. This includes existing technology, adaptable methods, and practical future design for retarding the potentially irreversible loss of priceless coastal features. A review of the scope of the interference of manmade works shows that it is difficult to deal with a coastal problem without considering all of the factors concerned. (Sinha-OEIS)  
W74-00034

#### CLIMB OF A BORE ON A BEACH. PART I. UNIFORM BEACH SLOPE,

Brown Univ., Providence, R.I.

D. V. Ho, and R. E. Meyer.  
Journal of Fluid Mechanics, Vol 14, No 2, p 305-318, October 1962. 6 fig, 11 ref. NONR 362 (07).

Descriptors: \*Beaches, \*Shallow water, \*Bores, Fluid mechanics, Hydrodynamics, Tides, Slopes. Identifiers: Similarity solutions, Directional singularity, \*Near shore processes, \*Coastal processes.

The shoreward travel of a bore into water at rest on a beach of uniform slope is studied to elucidate why, in a class of problems - mainly gas-dynamical ones involving non-uniform shock propagation - similarity solutions seem to act like magnets attracting other solutions. For the shallow-water problem, the real magnet is shown to be the shore singularity of the governing differential equations. The shore singularity of the solution is shown to be a directional singularity of the water acceleration, for a fairly wide range of conditions, and a rather detailed asymptotic approximation for the bore development near shore is deduced. (Sinha-OEIS)  
W74-00035

#### ENVIRONMENTAL STUDIES OF MONTEREY BAY AND THE CENTRAL CALIFORNIA COASTAL ZONE,

Moss Landing Marine Labs., Calif.

R. E. Arnal.  
Available from the National Technical Information Service as COM-7210696. Progress Report: July 1971 - February 1972. 94 p, 18 fig, 7 tab. SG 2-35137.

Descriptors: \*Plankton, \*Hydrography, \*Benthos, Fish, \*Productivity, \*Sediment transport, Sands, Education, \*Coasts, \*Bays.

Identifiers: Monterey Bay, \*Coastal processes, \*Near shore processes, Public services.

Details are given of work in progress in plankton studies, hydrographic work, benthic survey, and studies of productivity of fishes as well as sand transport in Monterey Bay. This is followed by explanations of the progress to date in providing additional education in the marine sciences for interested persons as well as information for the general public and public services for the communities of Monterey Bay. (Sinha-OEIS)  
W74-00036

#### SEASONAL VARIATIONS OF COASTAL CURRENTS OFF THE OREGON - NORTHERN CALIFORNIA COAST,

Naval Postgraduate School, Monterey, Calif.

W. F. Whitson.  
Available from the National Technical Information Service as AD-749 077, \$3.00 in paper copy, \$1.45 in microfiche. Master's thesis, June 1972. 52 p, 13 fig, 4 tab, 17 ref.

Descriptors: \*Coasts, \*Currents (Water), \*Upwelling, \*Winds, Subsurface flow, \*Climate, Ocean circulation, Shallow water, Oregon, California, Pacific coast region.

Identifiers: Surface jet, \*Near shore processes, \*Coastal processes, Pycnocline, Columbia River discharge, Pressure gradient, Volume transport, Geostrophic velocities, Baroclinic flow.

Seasonal longshore flow patterns are examined at four points along the Oregon-Northern California coast. Summer and winter activity is examined as far seaward as 25 nautical miles and as deep as 200 meters. Long-term mean hydrographic data are used to determine geostrophic velocities. A nearshore baroclinic southward flow is observed at each of the points during the summer. Winter currents are generally very small and largely barotropic in nature. Seasonal volume transports are presented; corrected velocity profiles are also presented based on data from moored current meters. Qualitative explanations of the observed phenomena are considered. (Sinha-OEIS)

## WATER CYCLE—Field 02

### Estuaries—Group 2L

W74-00037

**LONG TERM CHANGES IN MARINE ECOSYSTEM: ECOLOGICAL RELATIONSHIPS BETWEEN TOMALES BAY AND ADJACENT SHELF WATERS,**  
University of the Pacific, Dillon Beach, Calif. Pacific Marine Station.

S. J. Marcus, R. S. Houston, and E. H. Smith. Final Report, March 31, 1972. 50 p, 19 fig, 1 tab, 1 ref, 3 append. Proj. NR 104-931 ONR 00014-67-A-0291-0001.

Descriptors: Ecology, \*Coasts, \*Bays, Continental shelf, Data collections, \*Upwelling, Marine fisheries, Ecosystems, Commercial fishing.

Identifiers: Tomales Bay, Density structure, \*Coastal processes, \*Near shore processes.

An offshore measurement capability was developed along with the initial stage of data collection in the region adjacent to Tomales Bay. Preliminary analysis indicates that several cycles of coastal upwelling having a period of 5 to 6 weeks were observed by sequential measurements during the fall and winter months of 1969-1970. A low-cost operational capability has been achieved for the study of detailed density structure of shelf waters. Results not only provide some understanding of the processes affecting Tomales Bay, but indicate a possible relationship of the density structure to the movements of commercially important fish in the area. (Sinha-OEIS)  
W74-00038

**CAPACITIES OF SHALLOW WATERS OF SAGAMI BAY FOR OXIDATION AND REDUCTION OF INORGANIC NITROGEN,**  
Tokyo Univ. (Japan). Ocean Research Inst. For primary bibliographic entry see Field 05B. W74-00047

**BASELINE CONCENTRATIONS OF LIGHT HYDROCARBONS IN GULF OF MEXICO,**  
Texas A and M Univ., College Station. Dept. of Oceanography. For primary bibliographic entry see Field 05B. W74-00073

**EXPERIMENTAL HYDRODYNAMIC CALCULATION OF APERIODIC WATER-LEVEL FLUCTUATIONS IN ESTUARIES,**  
V. V. Ivanov, and Ye. P. Kotrekov. Soviet Hydrology: Selected Papers, No 4, p 354-362, 1971. 4 fig, 9 ref. Translated from Problems of the Arctic and Antarctic (Problemy Arktiki i Antarktiki), No 38, p 45-55, 1971.

Descriptors: \*Estuaries, \*Water level fluctuations, \*Frequency, \*Hydrodynamics, Unsteady flow, Waves (Water), Wind tides, Surges, Channel morphology, Discharge (Water), Cross-sections, Profiles, Equations. Identifiers: \*Yenisey River estuary (USSR).

Level fluctuations in estuaries depend on aperiodic and periodic sea level fluctuations and variations in river runoff. Using the Yenisey River as an illustration, hydrodynamic equations of unsteady flow were applied to the calculation of wind tides in an estuary reach typical of estuaries of large Siberian rivers. To study propagation of wind-induced level fluctuations in the Yenisey estuary, a large number of surges were calculated on the M-220 computer. Results are presented of calculations for one flood and ebb wave described by stage observations at a number of gaging stations and by discharge measurements. Hydromorphometric characteristics of the Yenisey River estuary are graphed for an average discharge of 20,100 cu m/sec and average sea level. (Josefson-USGS)  
W74-00114

**EFFECTS OF UNDERWATER DEMOLITION ON THE ENVIRONMENT IN A SMALL TROPICAL MARINE COVE,**  
Naval Underwater Systems Center, New London, Conn. New London Lab. For primary bibliographic entry see Field 05C. W74-00233

**COMPOSITIONAL STUDIES OF A HIGH-BOILING 370-535 C DISTILLATE FROM PRUDHOE BAY, ALASKA, CRUDE OIL,**  
Bureau of Mines, Bartlesville, Okla. Bartlesville Energy Research Center. For primary bibliographic entry see Field 05A. W74-00258

**ASSOCIATION OF HYDROCARBONS AND MINERAL PARTICLES IN SALINE SOLUTION,**  
Rhode Island Univ., Kingston. Graduate School of Oceanography. For primary bibliographic entry see Field 05B. W74-00265

**ORGANOCHLORINE RESIDUES IN ESTUARINE MOLLUSKS, 1965-72 - NATIONAL PESTICIDE MONITORING PROGRAM,**  
Environmental Protection Agency, Gulf Breeze, Fla. Office of Pesticide Programs. For primary bibliographic entry see Field 05C. W74-00291

**IN SITU MEASUREMENT OF SEDIMENT SOUND SPEED DURING CORING,**  
Texas Univ., Austin. Applied Research Labs. For primary bibliographic entry see Field 02J. W74-00294

**SEA-SURFACE CIRCULATION, SEDIMENT TRANSPORT, AND MARINE MAMMAL DISTRIBUTION, ALASKA CONTINENTAL SHELF,**  
Alaska Univ., College. Inst. of Marine Science. For primary bibliographic entry see Field 02J. W74-00298

**A SYSTEMATIC SURVEY OF INTERTIDAL OYSTERS IN THE SAVANNAH RIVER BASIN AREA OF SOUTH CAROLINA,**  
South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Center. For primary bibliographic entry see Field 05C. W74-00300

**PATTERNS OF SEDIMENT TRANSPORT AT NEARSHORE ZONES INFLUENCED BY WAVE AND TIDAL CURRENTS: A STUDY UTILIZING FLUORESCENT TRACERS,**  
Skidaway Inst. of Oceanography, Savannah, Ga. G. F. Oertel. Southeastern Geology, Vol 15, No 2, p 77-92, July 1973. 6 fig, 14 ref. USACE Contract DACW 72-68-C-0030, NSF Grant GA-30565.

Descriptors: \*Beaches, \*Sediment transport, \*Waves (Water), \*Tides, Surf, Sedimentation, Sedimentary structures, Sedimentology, Surges, Littoral drift, Currents (Water).

In nearshore zones, responses of detritus to moving water illustrate several different transportational and depositional patterns depending on the nature of the interactions between wave surge and tidal flow. At offshore, shallow, subtidal areas the greatest distances of sediment transport generally correspond to the direction of tidal flow, while bedform configurations are predominantly effected by wave surges. At offshore intertidal areas, bedform configurations and the greatest distances of sediment transport are largely controlled by surging waves. During the flooding tide, the approach directions of surging waves determine the bedform configurations and the greatest

distances of sediment transport. When wave surge and tidal currents are in opposing directions (during the ebbing tide), sediment is entrained in gyral paths. These sediment gyres cause deposition of sand in the horizontal strata of planar beds. At the shorelines adjacent to the estuary entrances, tidal currents and wave currents are in mutually evasive zones and patterns of sediment entrainment generally conform to the directions of the water flow in the respective zones. When tidal currents and longshore currents are in opposite directions, then the entrainment of sediment corresponds to the bipolar flow directions in the respective current zones. (Knapp-USGS)  
W74-00301

**TIDAL RELATIONS ALONG THE INTRACOASTAL WATERWAY, PALM BEACH, COUNTY, FLORIDA,**  
Geological Survey, Tallahassee, Fla.

J. J. Schneider. Open-file Report 73021, 1973. 22 p, 6 fig, 2 tab, 4 ref.

Descriptors: \*Tides, \*Inland waterways, \*Florida, \*Tidal waters, \*Water level fluctuations, Diurnal, Sea level, Ocean currents, Data collections, Time. Identifiers: \*Tidal data, \*Palm Beach County (Fla.), High tide, Low tide, Tidal range, Tidal time difference, Intracoastal waterway.

Prior to this investigation there was little tidal data for the Intracoastal Waterway in Palm Beach County, Florida. The purpose of this study, therefore, was to determine for this reach of the waterway: (1) mean high water; (2) mean low water; (3) mean sea level; (4) mean half tide; (5) mean tidal range; and (6) average tidal time difference, and to relate these values to the ocean tides at Miami Beach. From September 1, 1971 through August 31, 1972, mean high water along the Intracoastal Waterway in Palm Beach County ranged from 1.71 to 1.87 feet above mean sea level, datum of 1929. The mean tidal range varied from 2.33 to 2.69 feet. The difference between half tide and mean sea level varied between -0.01 foot at Delray Beach to +0.05 foot at Juno Beach with a zero variation at Southern Blvd. and Blue Heron Blvd. The average time difference for high tides referred to Miami Beach, ranged from plus 20 minutes at Riviera Beach to plus 1 hour and 50 minutes at Delray Beach. (Woodard-USGS)  
W74-00328

**LAND USE AS A FACTOR IN COASTAL WATER POLLUTION,**  
California Univ., Berkeley.

P. H. McGahey. In: Proceedings of 13th Coastal Engineering Conference, July 10-14, 1972. Sponsored by Coastal Engineering Research Council and Waterways, Harbours and Coastal Engineering Division. p 2091-2097 (1972).

Descriptors: \*Land use, \*Water quality, \*Coasts, Hawaii, Estuaries, Seashores, Urbanization, Water pollution effects, Water quality control, Standards, Institutional constraints, Social aspects. Identifiers: \*Coastal zone.

More knowledge of land use, development, and management practices is needed to ascertain their effect on coastal waters. It is also necessary to know enough about natural shifts in ecosystems and what kind of ecosystems should be maintained, or can be maintained, to make intelligent tradeoffs between land and water quality decisions. Reexamination should be made of degree of freedom that goes with the land to adapt it to a population load now bringing these waters to a condition of great concern. A Hawaiian study is developing criteria to relate coastal water quality to land management practices and to evaluate coastal zone resources both landward and seaward

## Field 02—WATER CYCLE

### Group 2L—Estuaries

of the shoreline. This affords an opportunity to establish some baseline against which to evaluate human activity on land—a need that can not be overemphasized. There are situations such as Kaneohe Bay where intense urbanization of a coastal valley has occurred, and changes in water quality and biota have been observed in the presence of treated sewage. Plans to discharge sewage elsewhere are in progress and the opportunity is developing to observe changes in the environment and in the biota when only urban runoff afflicts the waters. (Jones-Wisconsin)  
W74-00383

#### AN EVALUATION OF MIXING IN THE TAY ESTUARY, East of Scotland Water Board, Invergowrie (Scotland).

J. R. West, and D. J. A. Williams.

In: Proceeding of 13th Coastal Engineering Conference, July 10-14, 1972, Sponsored by Coastal Engineering Research Council and Waterways Harbours and Coastal Engineering Division, p 2153-2169 (1972). 9 fig.

Descriptors: \*Mixing, \*Estuaries, \*Mathematical models, \*Salinity, \*Dispersion, Tidal effects, Flow characteristics, Saline water intrusion.

Identifiers: \*Firth of Tay (United Kingdom).

A one dimensional form of the solute mass balance equation to obtain a mathematical representation of salinity distribution in the Tay Estuary (United Kingdom) is described. An apparent coefficient of dispersion and a net mixing term are defined, evaluated, and correlated to fluvial discharge and distance along the estuary. Reference is made to the proper reduction of dimensionality and time averaging of the instantaneous three dimensional solute mass balance equation. The conditions of significant tidal variation of both channel cross sectional area and solute concentration are recognized. This equation is a useful preliminary approach to the study of mixing in an estuary. While unsatisfactory from a physical point of view, the introduction of an apparent dispersion coefficient provides, along with other functions, an algebraic representation of the effects of processes that lead to what is here called the net mixing. The yield of physical information is limited to an estimate of the net effects of the physical processes of solute transport over a tidal cycle. In the Tay Estuary the apparent dispersion coefficient and net mixing are highly dependent upon distance along the estuary and mean river flow. (Jones-Wisconsin)  
W74-00384

#### A NUMERICAL MODEL OF THE ST. LAWRENCE RIVER, National Research Council of Canada, Ottawa (Ontario). Hydraulics Lab.

D. Prandle.

In: Proceedings of 13th Coastal Engineering Conference, July 10-14, 1972, Vancouver, B.C., Sponsored by Coastal Engineering Research Council and Waterways, Harbours and Coastal Engineering Division, p 2291-2305 (1972). 8 fig.

Descriptors: \*Estuaries, \*Mathematical models, \*St. Lawrence River, Tidal effects, Flow characteristics, \*Canada, Water levels, Velocity, Tides, Analytical Techniques.

A combined one and two-dimensional model of a 340-mile section of the St. Lawrence River was formulated, employing an explicit finite difference solution. A half mile square grid was used to schematize an area approximately 20 miles long by 15 miles wide. The two-dimensional model was embodied within the one-dimensional model permitting free interaction of flow across the boundaries. By combining the two models an accurate simulation of a particular short reach of a river was achieved. This technique has widespread applications subject to limitations of the two-dimen-

sional model. The problem of flow visualization associated with numerical models was examined. For the one-dimensional model use of contours to represent water elevation plotted against time and distance along the river was found extremely useful. For the two-dimensional model animation techniques were used. A movie film was made that demonstrates both tidal rise and fall and associated horizontal velocities. Elevation was reproduced by use of colored paper to simulate contours, velocities were represented by simulating drogue movement to produce smoke streaks. (Jones-Wisconsin)  
W74-00385

#### ANALYTICAL MODELING OF ESTUARINE CIRCULATION,

Virginia Univ., Charlottesville. Dept. of Environmental Sciences.

J. S. Fisher, J. D. Ditmars, and D. R. F. Harleman. In: Proceedings of 13th Coastal Engineering Conference, July 10-14, 1972, Vancouver, B.C., Sponsored by Coastal Engineering Research Council and Waterways, Harbours and Coastal Engineering Division, p 2307-2317 (1972). 2 fig.

Descriptors: \*Analytical techniques, \*Mathematical models, \*Estuaries, \*Circulation, Distribution, Salinity, Velocity, Tidal effects, Equations, Flow, Freshwater, Shoals.

A two-dimensional analytical model of estuarine circulation including vertical and longitudinal distributions of velocity and salinity is developed. Relationships between the various time-averaged coefficients of turbulent diffusion and eddy viscosity are included and gross parameters of estuarine circulation obtained. Flow is assumed laterally homogeneous and the estuary width and depth are assumed to be functions of the longitudinal coordinate only. Salt intrusion length, ocean boundary salinity, distribution of depth-averaged salinity and freshwater discharge are required inputs to the model. The vertical and longitudinal equations of motion, continuity, salt conservation and an equation of state are the governing equations included. The key assumption is made that longitudinal salinity gradient is independent of depth. This decouples these equations and thus permits an analytical solution. The model solutions, from data of laboratory flume and field surveys, are used to find correlations for the mean vertical transfer coefficients of mass and momentum with gross characteristics of the estuary. These correlations, plus results from a one-dimensional numerical model, permit this analytical model to be used as predictor of velocity and salinity profiles in estuaries and to relate changes in freshwater discharge to possible changes in the location of shoaling zones. (Jones-Wisconsin)  
W74-00386

#### ELECTRICAL RESISTIVITY SOUNDINGS ON THE COASTAL PLAIN OF SOUTHEASTERN VIRGINIA: A FEASIBILITY STUDY, Old Dominion Univ., Norfolk, Va. Dept. of Geophysical Sciences.

For primary bibliographic entry see Field 02F.  
W74-00437

#### ZOOBENTHOS RESOURCES AND PRODUCTIVITY IN THE GULF OF TAGANROG, (IN RUSSIAN),

Azovskii Nauchno-Issledovatel'skii Institut Rybnoi Khozyaistva, Rostov-na-Donu (USSR). For primary bibliographic entry see Field 05C.  
W74-00495

#### SEMIIDIURNAL INTERNAL TIDES IN MASSACHUSETTS BAY,

National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Oceanographic Labs. D. Halpern.

Journal of Geophysical Research, Vol 76, No 27, p 6573-6584, September 20, 1971. 7 fig, 3 tab, 31 ref.

Descriptors: Temperature, \*Gravity waves, \*Bays, \*Coasts, Massachusetts, Measurement, Tidal waters.

Identifiers: \*Massachusetts Bay, \*Internal tides, \*Temperature measurement, Tidal cycles, Wave energy.

Semidiurnal tidal internal gravity waves consisting of the first five modes account for over 50% of the fluctuations that occurred in temperature measurements made at fixed depths in Massachusetts Bay. The amplitude of the lowest mode is the largest, while that of the second mode is negligible. The minimum value of the Richardson number of the internal wave of five modes is unity, and there is an indication that during each tidal cycle a dynamic instability may occur. The total internal wave energy occurring in a bandwidth of .00732 cph, centered on the semidiurnal frequency, is approximately 430,000 ergs/sq cm, which is about 8.6% of the total energy of the barotropic tide. These results, which were deduced from linear theory, may not be entirely accurate because the asymmetry of the temperature trace suggests non-linear wave profiles, and because of the possible presence of microstructure. (Sinha-OEIS)  
W74-00504

#### ON THE ANGULAR ENERGY SPECTRUM OF WIND WAVES, For primary bibliographic entry see Field 02E. W74-00505

#### WATER-LEVEL FLUCTUATIONS AND FLOW IN TIDAL INLETS, National Engineering Science Co., Pasadena, Calif.

J. Van de Kreeke. Journal of the Waterways and Harbors Division, American Society of Civil Engineers, Vol 93, No WW4, Proceedings Paper 5575, p 97-106, November 1967. 6 fig, 5 ref, append.

Descriptors: \*Inlets (Waterways), Tides, \*Water level fluctuations, Mathematical models, Coasts, \*Australia, Equations.

Identifiers: \*Tidal inlets, \*Water motion, \*Tasmania (Macquarie Harbour), Fresh water inflow.

Equations are derived to describe the water motion in a tidal inlet connecting the ocean with a relatively small basin. The boundary conditions considered are the ocean tide and fresh water inflow. No density effects are taken into account. A dimensionless resistance coefficient is introduced to express the influence of the inlet channel resistance on the water motion. A numerical method to solve the equations is presented. For a better physical insight, the analytic solution is presented for a simplified set of equations, in which the quadratic resistance term is replaced by a linear term. It appears that after a certain transition period the water level fluctuations in the bay become steady, the 'steady state' fluctuations being independent of the initial conditions. Numerical computations are carried out for the inlet of Macquarie Harbour, Tasmania. The results, for a case in which no fresh water inflow is considered, are compared with the results obtained according to Keulegan's method and with the results obtained with the help of the simplified (linear) set of equations. They appear to be in close agreement. (Sinha-OEIS)  
W74-00507

#### TIDAL CHARACTERISTICS OF TWO ESTUARIES IN FLORIDA, For primary bibliographic entry see Field 05B. W74-00508

## WATER CYCLE—Field 02

### Estuaries—Group 2L

**THE EQUATIONS OF MASS CONTINUITY AND SALT CONTINUITY IN ESTUARIES,**  
Johns Hopkins Univ., Md. Chesapeake Bay Inst.  
D. W. Pritchard.  
Journal of Marine Research, Vol 17, p 412-423,  
1958. 3 ref.

Descriptors: \*Estuaries, Mathematics, Tidal effects, Equations, Mass, Equation.

Identifiers: \*Estuarine processes, \*Mass continuity, \*Salt continuity, Slack water, Phase difference.

Equations of mass (or volume) continuity and salt continuity are developed for the two- and one-dimensional estuary from the basic forms of these equations in three dimensions. The three cases of vertical, lateral, and sectional homogeneity are treated. Some misuses of the continuity concepts as applied to estuaries have appeared in recent literature. These are discussed. The effect of phase difference between tidal slack water and high tide on the nontidal drift in sectionally homogeneous estuaries is presented. (Sinha-OEIS) W74-00512

**CLASSIFICATION SYSTEM FOR ESTUARIES,**  
Norconsult A/S., Oslo (Norway).

B. Glenne.

Journal of the Waterways and Harbors Division, American Society of Civil Engineers, Vol 93, No WW1, Proceedings Paper 5084, p 55-61, February 1967. 5 fig, 8 ref.

Descriptors: \*Estuaries, \*Tidal effects, Mixing, Diffusion, \*Classification, Friction, Stratification, Hydrology, \*California, Coasts.

Identifiers: Advective flow, \*San Francisco Bay.

An attempt is made to improve the communications between estuarine investigators by providing a classification system for natural occurring estuaries, based on readily measurable physical parameters. Because quantitative information regarding mixing processes is presently relatively sparse, the classification system is based mainly on hydrographical, tidal, and hydraulic parameters. The classification system is schematically pictured and quantitatively defined wherever possible. (Sinha-OEIS)

W74-00511

**NATURAL INDICATORS OF ESTUARINE SEDIMENT MOVEMENT,**  
Oregon State Univ., Corvallis. Dept. of Oceanography.

J. V. Byrne, and L. D. Kulum.

Journal of the Waterways and Harbors Division, American Society of Civil Engineers, Vol 93, No WW2, Proceedings Paper 5220, p 181-194, May 1967. 8 fig, 3 tab, 14 ref. ONR Contract Nonr 1286 (10).

Descriptors: \*Sediment transport, \*Estuaries, \*Beaches, Near shore, Bays, Tidal effects, Sedimentation, Runoff, \*Littoral drift, Winds, \*Oregon, Seasonal.

Identifiers: \*Yaquina Bay (Ore.), \*Near shore processes, Tidal currents, Onshore winds, Tidal flats.

Sediment movement within Yaquina Bay, Oregon, has been determined through the use of sediment texture and composition and related to the hydrography of the estuarine system. These natural indicators reveal at least two major sources of sediment - a river source and a beach or nearshore source. Marine sands are introduced into the bay by tidal currents or by onshore winds and transported upstream six miles from the bay entrance. Sands from the Yaquina River remain within the estuary while the suspended silts and clays are deposited primarily on tidal flats or carried out to sea on the ebb tide. Sedimentation in Yaquina Bay appears to be largely seasonal. Maximum deposition occurs during the winter and spring when

river runoff is highest. During these seasons littoral drift, coastal winds, and estuarine hydrographic system promote the transport of beach or nearshore marine and dune sands into the estuary. During summer and fall, deposition is slight due to less favorable climatic and hydrographic conditions. (Sinha-OEIS)

W74-00512

**INITIAL WAVE SCATTERING BY AN INHOMOGENEOUS MEDIUM AND ITS APPLICATION TO SHALLOW WATER WAVES,**  
Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science.

E. J. Katz.

Journal of Geophysical Research, Vol 67, No 12, p 4713-4719, November 1962. 1 fig, 6 ref. Nonr 248 (56).

Descriptors: \*Shallow water, \*Tsunamis, \*Waves (Water), \*Coasts.

Identifiers: \*Near shore processes, \*Wave scattering, Inhomogeneous medium.

The initial scattering of a scalar wave function by a statistically homogeneous medium is discussed for an unspecified, scattering, source distribution. The angular distribution of scattered energy and the attenuation of the incident wave energy are obtained which, in a three-dimensional space, yield Batchelor's earlier results. The comparison provides an estimate of the region included in his far field approximation. The present analysis is then applied to a class of scattering problems which includes the scattering of shallow water waves by a random depth. With the aid of a particular spectral function for the depth autocorrelation, an inadequacy of the single scattering technique (first Born approximation) is highlighted for certain large-scale inhomogeneities. It is then quantitatively suggested that an important shallow ocean wave (a tsunami) cannot be studied by single scattering. (Sinha-OEIS)

W74-00513

**A METHOD FOR DETERMINING THE BEHAVIOR OF LONG WAVES CLIMBING A SLOPING BEACH,**  
North Carolina State Univ., Raleigh Dept. of Civil Engineering.

For primary bibliographic entry see Field 02G.  
W74-00515

**FORMATION OF THERMAL MICROSTRUCTURE IN A NARROW EMBAYMENT DURING FLUSHING,**  
Washington Univ., Seattle. Applied Physics Lab.

J. T. Shaw, and G. R. Garrison.  
Journal of Geophysical Research, Vol 64, No 5, p 533-539, May 1959. 6 fig, 2 ref.

Descriptors: \*Thermal stratification, Seasonal, \*Coasts, \*Bays, \*Washington.

Identifiers: \*Puget Sound (Wash.), Flushing, Embayments, Temperature measurements, \*Near shore processes, Isothermal diagrams.

Thermal microstructure formations, coincident with the occurrence of flushing in a narrow Puget Sound embayment, have been observed and measured with a high-sensitivity probe. Accompanying the larger formations which extend horizontally for thousands of yards, a microstructure is shown to exist which consists of elongated layers extending hundreds of yards with temperature differences of less than 0.1 degree C. Two series of isothermal diagrams constructed from vertical temperature measurements taken in the area during winter and summer flushing are presented to show the manner in which such formations are developed. (Sinha-OEIS)

W74-00517

**WAVE REFRACTION PATTERNS IN HAWKE BAY,**  
Department of Scientific and Industrial Research, Wellington (New Zealand). Oceanographic Inst.  
J. G. Gibb.

New Zealand Journal of Geology and Geophysics, Vol 5, No 3, p 435-444, August 1962. 6 fig, 1 tab, 6 ref.

Descriptors: \*Waves (Water), \*Refraction, \*Shallow water, Surf, Harbors, \*Coasts, \*Bays.

Identifiers: Near Shore processes, \*New Zealand (Hawke Bay), Snell's law.

When a wave originating in deep water enters shallow water, i.e., water whose depth is less than half the wavelength, the velocity of the wave is reduced. Refraction, i.e., the distortion of wavefronts by wave-velocity changes, will therefore occur when a wave-front enters shallow water. The process is analogous to the bending of light rays in optical systems, and the relations are expressed by Snell's law. Wave refraction diagrams are presented and discussed for Hawke Bay and for two nearshore areas within the Bay. Generally there are no marked refraction effects in the Bay as a whole, except near Cape Kidnappers and Portland Island. In the Napier Harbour area, Pania Rock and adjacent banks are the principal factors affecting the smooth pattern of wave fronts. For the Clifton-Awatah area the direction of longshore currents produced by the refracted waves is shown to be predominantly northward. (Sinha-OEIS)

W74-00518

**STUDIES ON THE CURRENTS IN THE LITTORAL ZONE OF THE WALTAIR BEACH,**  
Andhra Univ., Waltair (India). Dept. of Meteorology and Oceanography.

For primary bibliographic entry see Field 02J.

W74-00519

**COASTAL PROCESSES AROUND THE OTAGO PENINSULA,**  
Otago Univ., Dunedin (New Zealand). Dept. of Geology.

For primary bibliographic entry see Field 02J.

W74-00521

**SALINITY OF INTERSTITIAL WATER IN A SANDY BEACH,**  
Chicago Univ., Ill. Dept. of the Geophysical Sciences.

R. G. Johnson.

Limnology and Oceanography Vol 12, No 1, p 1-7, January 1967. 1 fig, 3 tab, 12 ref.

Descriptors: \*Salinity, Circulation, \*Beaches, \*Tidal effects, Bays, \*Shallow water, Sands, \*California.

Identifiers: \*Tomales Bay (Calif), Intertidal sand, Tidal cycle.

The salinity in the upper 20 cm of intertidal sands was observed at two stations in Tomales Bay, California. In summer, there were no striking variations associated with elevation, except for the effect of evaporation. In winter, the influx of freshwater provides sufficient contrast between interstitial and open water to reveal features of circulation. High on the beach, the interstitial salinity at the 10- and 20-cm depth remains low through the tidal cycle. The salinity at 10 cm remains higher than at 20 cm. At an elevation of 1.0 m, the salinities at 10 and 20 cm converge. Below this elevation, interstitial salinity varies less than in the adjacent open waters of the bay. The environment of the infauna of the low intertidal zone is more stable than that of epifaunal or pelagic organisms in shallow water. The variations high in the intertidal zone must constitute a major obstacle to the spread of marine organisms into this area. (Sinha-OEIS)

W74-00523

## Field 02—WATER CYCLE

### Group 2L—Estuaries

**EFFECTS OF THE ALASKA EARTHQUAKE AND TSUNAMI ON RECENT DELTAIC SEDIMENTS,**  
Scripps Institution of Oceanography, La Jolla, Calif.  
For primary bibliographic entry see Field 02J.  
W74-00524

**TIDAL VARIATION OF THE SIZE DISTRIBUTION OF SUSPENDED SEDIMENT AT A STATION IN THE CHESAPEAKE BAY TURBIDITY,**  
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.

J. R. Schubel.

Netherlands Journal of Sea Research, Vol 5, No 2, p 252-266, 1971. 8 fig, 5 tab, 3 ref.

Descriptors: \*Sedimentation, \*Deposition (Sediments), \*Estuaries, \*Coasts, \*Turbidity, Tidal effects, \*Chesapeake Bay.

Identifiers: Suspended sediments, \*Tidal cycle, Size distribution.

The results of sedimentation size analyses of samples collected over a tidal cycle at a station within the turbidity maximum of the Chesapeake Bay are presented. The suspended particle population consists of two sub-populations - those particles in more or less continual suspension throughout the water column, and those particles alternately suspended and deposited. The background particles (stable volume-size distribution) are derived in part directly from run off; and in part from primary productivity, from shore erosion, and from resuspension. These very fine-grained particles have a volume weighted mean settling velocity of the same order as the mean vertical mixing velocity. This appears to explain their narrow, stable size distribution, and their sustained suspension. (Sinha-OEIS)

W74-00525

**A TEST OF MIXING LENGTH THEORIES IN A COASTAL PLAIN ESTUARY,**  
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.

R. E. Kent, and D. W. Pritchard.

Journal of Marine Research, Vol 18, No 1, p 62-72, June 30, 1959. 4 fig, 1 tab, 8 ref.

Descriptors: \*Estuaries, Coasts, \*Mixing, Density, \*Stratification, Wind, Salinity, Circulation, \*Virginia, \*Coastal plains.

Identifiers: Estuarine processes, Wind waves, \*Mixing length, James River estuary.

The purpose was to demonstrate that the mixing length associated with vertical diffusion of salt in a stratified estuary may be formulated in terms of the stability of the system and of an adiabatic mixing length determined by the geometry of the system. Observations of vertical and horizontal variations in salinity and velocity in the James River estuary have been previously employed in the indirect determination of the vertical eddy flux of salt (Pritchard, 1954). This term is employed here to compute a mixing length after the definition of Prandtl. It is shown that this observed mixing length is qualitatively similar to a theoretical one formulated from the geometry of the system and a stability parameter related to the density stratification of the system. Several alternate hypotheses regarding the theoretical mixing length are tested. Better quantitative agreement is obtained when the influence of surface wind waves is included in the formulation of the theoretical mixing length. (Sinha-OEIS)

W74-00528

**APPLICATION OF ECOLOGICAL, GEOLOGICAL AND OCEANOGRAPHIC ERTS-1 IMAGERY TO DELAWARE'S COASTAL RESOURCES PLANNING,**  
Delaware Univ., Newark. Coll. of Marine Studies. For primary bibliographic entry see Field 07B.  
W74-00540

## 03. WATER SUPPLY AUGMENTATION AND CONSERVATION

### 3A. Saline Water Conversion

#### ANALYTICAL AND EXPERIMENTAL STUDIES OF REVERSE OSMOSIS SYSTEMS,

Clarkson Coll. of Technology, Potsdam, N.Y.  
B. Bansal, R. DeLuca, L. J. Derzansky, A. K. Dewan, and R. Mehandra Doshi.

Available from the National Technical Information Service as PB-222 118, \$9.75 in paper copy, \$1.45 in microfiche. Office of Saline Water, Research and Development Progress Report No 854, May 1973. 146 p, 39 fig, 11 tab, 59 ref. append. Contract 14-01-0001-1816.

Descriptors: \*Desalination, \*Reverse osmosis, \*Membranes, Boundary layers, Viscosity, Diffusivity, Laminar Flow.

Identifiers: \*Concentration polarization, Hollow fibers, Tubular membranes.

The report is divided into four chapters as follows: (1) The Effect of Concentration Dependent Viscosity and Diffusivity on Concentration Polarization in Reverse Osmosis Flow Systems. (2) Reverse Osmosis: Increased Productivity by Reduction of Concentration Polarization in Laminar Flow Reverse Osmosis Using Intermediate Non-Rejecting Membrane Sections. (3) Hollow Fiber Reverse Osmosis Systems Analysis and Design. (4) Experimental Studies of Reverse Osmosis with Tubular Membranes. (OSW) W74-00039

#### EVALUATION OF THE RELIABILITY AND MAINTAINABILITY OF DESALTING PLANTS.

Hittman Associates, Inc., Columbia, Md.

Available from the National Technical Information Service as PB-221 121, \$11.00 in paper copy, \$1.45 in microfiche. Office of Saline Water, Research and Development Progress Report No 859, August 1972. 164 p, 48 ref, 29 tab, 47 ref. Contract 14-30-2848.

Descriptors: Standards, Distillation, \*Desalination, Brines, \*Flash distillation, Evaluation.

Identifiers: Product water, Water production, Heat rejection, \*Reliability, \*Maintainability.

Results are presented of applying reliability and maintainability engineering analysis techniques to the 2.5 MGD Universal Desalting Plant design for a multistage flash seawater distillation plant and evaluating the economics of applying these techniques in other programs. A 14 percent increase in predicted availability, from 77 to 88 percent, results from design modifications to critical component areas. The modifications result in a 9 percent decrease in product water cost, from 140¢/1000 gallons to 128¢/1000 gallons. An interactive analysis is defined for optimizing product water cost with respect to availability. A plan is presented for developing a formal reliability and maintainability engineering program in the Office of Saline Water. (OSW) W74-00040

#### DESALINATION PROCESS,

Rohm and Haas Co., Philadelphia, Pa. (Assignee) F. J. Glavis, and D. H. Clemens.

U.S. Patent No. 3,753,898, 4 p, 4 ref; Official Gazette of the United States Patent Office, Vol 913, No 3, p 948, August 21, 1973.

Descriptors: \*Patents, \*Desalination, Saline water, Potable water, \*Polymers, \*Polyelectrolytes, \*Ion exchange, \*Water treatment, Treatment.

Saline water is contacted with polyelectrolyte insoluble in acid solution. The polyelectrolyte is a cross-linked polymer having ion exchange properties. It has a glass transition temperature, i.e. a  $T_g$ , in the dry state of at least about 25 degrees C and up to about 65 degrees C. The polymer preferentially sorbs water from the saline water and forms a hydrate with it. The solute concentration in the remaining saline water is increased, removing the resulting hydrated polymer from the remaining saline water. The hydrated polymer is heated to at least 10 degrees C above the datum temperature and removes purer water from the polyelectrolyte. The purified water is thermally released from the polymer and the polymer is used over again. Cross-linked acrylic polymers are preferred. (Sinha-OEIS)  
W74-00081

#### MEMBRANE PROCESSES (OSMOSIS AND REVERSE OSMOSIS),

Yugoslav Academy of Sciences and Arts, Dubrovnik Inst. for Marine Corrosion and Desalination. B. Kunst, G. Arneri, P. Goran, and A. M. Basnec. Available from the National Technical Information Service as PB-219 393, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No 84, March 1973. 39 p, 10 fig, 14 tab, 7 ref. 14-01-0001-1427.

Descriptors: \*Desalination, \*Reverse osmosis, \*Membrane processes, \*Permeselective membranes, \*Osmosis, Sea water, Evaporation, Solvents.

Identifiers: Cellulose acetate.

The research has two main goals: (1) the development of more productive osmotic and reverse osmotic membranes for the sea water desalination, and (2) an optimal design of elements for osmosis and reverse osmosis units. Previous work on the general problem of making more productive reverse osmotic membranes resulted in new classes of porous cellulose acetate reverse osmotic membranes for low pressure work of highly increased (100%) productivities, as well as in a new concept on the mechanism of membrane formation, named solution structure - evaporation rate concept. In this concept the state or the structure of the casting solution and the rate of solvent evaporation during film formation together constitute important related variables governing the ultimate porous structure and hence the performance of the resulting membranes in reverse osmosis. Investigations were undertaken to further the understanding of the mechanism of the membrane formation process. Changes in reverse osmotic membrane performances caused by including another solvent, dioxane, as a substitution for a part of acetone in a casting dope were studied. Apparatus was constructed, built and tested for the solvent evaporation rate measurement. (OSW) W74-00145

#### ION-SELECTIVE ELECTROCHEMICAL SENSORS,

Texas Instruments, Inc., Dallas.

I. Trachtenberg.

Available from the National Technical Information Service as PB-219 394, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No 844, March 1973. 104 p, 26 fig, 18 tab, 24 ref. 14-01-0001-1737.

Descriptors: \*Desalination, \*Electrodes, Water purification, Electrochemistry, Calcium, Magnesium, Sulfates, Iron, Copper, \*Ion exchange. Identifiers: \*Ion selective electrodes, Nonoxide glasses, \*Sensors (Electrochemical).

Ion-selective electrochemical sensors can provide a means for rapidly determining and continuously monitoring the concentration of a variety of ionic species in aqueous solutions, particularly saline

## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

### Saline Water Conversion—Group 3A

and brackish waters. The development of novel ion-selective sensors was the goal of this research program. Specifically, the program goal was to develop inexpensive, chemically durable, and highly selective electrochemical sensors which would provide rapid and specific response to  $\text{Fe}^{+3}$ ,  $\text{Cu}^{+2}$ ,  $\text{Ca}^{+2}$ ,  $\text{Mg}^{+2}$ ,  $\text{Na}^{+}$ ,  $\text{K}^{+}$ , and  $\text{SO}_4^{2-}$  in saline and brackish water. The primary approach was to investigate the use of nonoxide materials, both crystalline and amorphous, which, when fabricated into sensors, gave selective response to the specific ions of interest. The research program had four major parts: sensor material preparation; material characterization, including resistivity; sensor preparation and evaluation for ion selectivity; and sensor mechanism studies. (OSW)

W74-00146

#### METHODS FOR CONTROLLING MARINE FOULING IN INTAKE SYSTEMS

Dow Chemical Co., Freeport, Tex.  
D. C. Mangum, B. P. Sheperd, and W. F. McIlhenny.

Available from National Technical Information Service as PB-221 909, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No 858, June 1973. 124 p, 32 fig, 18 tab, 32 ref. 14-30-2829.

Descriptors: \*Desalination, \*Intakes, Intake structures. \*Fouling, Economics, Heated water, Corrosion, Water quality control, \*Chlorine.

Identifiers: \*Intake systems, Chlorine control, Copper alloy liners.

Principal marine fouling organisms along the Pacific, Atlantic, and Gulf Coasts of the United States have been identified. Various control methods have been experimentally evaluated on sea water. Control of fouling must be considered at all phases of desalting plant design, construction, and operation. Chlorine is the toxin of choice for most sea water intake systems. (OSW)

W74-00148

#### MUNICIPAL DESALTING STUDIES FOR SELECTED KANSAS COMMUNITIES

Wilson and Co., Salina, Kans.

For primary bibliographic entry see Field 05F.

W74-00156

#### IMPROVED ETHYL CELLULOSE MEMBRANES FOR REVERSE OSMOSIS APPLICATION

Gulf South Research Inst., New Orleans, La.

J. K. Smith, and E. Klein.

Available from the National Technical Information Service as PB-222 288, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No 863, January 1973. 35 p, 5 fig, 12 tab, 12 reg.

Descriptors: \*Membranes, \*Reverse osmosis, \*Semipermeable membranes, \*Permeability, \*Desalination, Films, Mass transfer, Brackish water, \*Polymers. Identifiers: Ethyl cellulose membranes, Solubility parameters, Asymmetric membranes, Membrane casting variables, Tubular ethyl cellulose membranes.

Ethyl cellulose, a very chemically stable polymer has been studied for the formation of asymmetric membranes for reverse osmosis. A solution prediction model has been developed which allows the formation of asymmetric membranes from a large number of solvent combinations. The data from both flat sheet and tubular asymmetric ethyl cellulose membranes reveal an outstanding stability to alkaline solutions, good rejections for most solutes but relatively low flux. The compaction of these membranes is of the same degree as cellulose acetate. (OSW)

W74-00157

#### NEW MEMBRANE COMPOSITIONS FOR DESALINATION OF WATER BY REVERSE OSMOSIS

Monsanto Research Corp., Dayton, Ohio.

P. H. Wilken, A. J. Blardelli, J. L.

Schwendeman, I. O. Salyer, and L. E. Erbaugh. Available from the National Technical Information Service as PB-220 145, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No 862, November 1972. 40 p, 2 fig, 12 tab.

Descriptors: \*Membranes, \*Reverse osmosis, \*Permeable membranes, \*Permeability, \*Semipermeable membranes, \*Desalination, Films, Membrane processes, Pressure, Separation techniques.

Identifiers: Ethylene/vinyl acetate copolymers, Vinyl alcohol/vinyl acetate copolymers, Acrylonitrile copolymers, Polyblends, Compression molding, Solution casting.

Dense membranes of acrylonitrile/methylvinylpyridine (50/50) compositions had excellent handling and processing characteristics and rejected 73% of sodium chloride from a 35,000 ppm feed stock at 1200 psig, at a flux of 0.23 gfd. Although the salt rejection is lower, the flux is more than double that of comparable membranes of cellulose acetate (95%, 0.1 gfd). 'Asymmetric' membranes prepared from 15% solutions of acrylonitrile/methylvinylpyridine copolymer in dimethylacetamide/glycerine (85/15) were prepared. Coagulated membranes gave 80% rejection of sodium chloride (3.5%) at a flux of 1.6 gfd. In the vinyl acetate polymers and copolymers, the best salt rejection and flux was obtained in vinyl acetate/vinyl alcohol copolymers containing from 10 to 25% vinyl alcohol. Thin dense membranes in this range of vinyl alcohol content rejected 84% of sodium chloride (3.5%) at a flux of 0.1 gfd. (OSW)

W74-00158

#### DEVELOPMENT OF IMPROVED MEMBRANES FOR REVERSE OSMOSIS

Hercules, Inc., Cumberland, Md. Allegany Ballistics Lab.

R. V. Cartwright, M. A. Grable, and B. M. Ruggelman.

Available from the National Technical Information Service as PB-221 699, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No 857, May 1973. 86 p, 5 fig, 14 tab, 18 ref. Contract 14-30-3011.

Descriptors: \*Desalination, \*Membrane processes, \*Reverse osmosis, \*Gels, \*Polymers, \*Permeability.

Identifiers: Crosslinking, Ultra-thin membranes, Polyethers, Cellulose ethers, Butadiene, Vinyl pyridine, Salt rejection.

The goal was to develop a new polymer for single-stage seawater conversion, that castable, high in performance and resistant to hydrolytic degradation. To this end, an investigation was made into three classes of hydrophilic polymers shown earlier to have promise for use in reverse osmosis membranes. The polymers, which include cellulose, vinyl copolymers, and polyethers, were modified to effect water insolubility and to form structures which contained a high proportion of Lewis base functionality. Films of these materials were evaluated for water and salt permeability and performance in reverse osmosis. (OSW)

W74-00159

#### EVALUATION OF ASYMMETRIC HOLLOW FIBERS FOR DESALINATION BY REVERSE OSMOSIS

Amicon Corp., Lexington, Mass.

D. S. Cleveland, M. Rambeau, A. Czernicki, and

T. R. Rich.

Available from the National Technical Information Service as PB-221 654, \$1.45 in microfiche. Office of Saline Water Research and Development

Progress Report No 856, April 1973. 34 p, 4 fig, 4 tab, 1 ref. 14-30-3010.

Descriptors: \*Desalination, \*Reverse osmosis, Cellulose, \*Membranes.

Identifiers: \*Cellulose acetate, \*Hollow fibers, Nomex, Polyacrylic acid, Polysulfone, Tubules, Burst pressure, Composite membranes, Spinnetere.

Asymmetric hollow fiber membranes with the discriminating skin on the inside of the fiber were prepared from aromatic polyamides (Nomex) and cellulose acetate. These fibers have an inside diameter of 0.018 in. and a wall thickness ranging from 0.002 in. to 0.007 in. Nomex fibers gave water flux rates of 20 GSFD at 40% magnesium sulfate and 20% sodium chloride rejection levels when tested with a 1500 ppm brackish feed brine. The burst pressure of these fibers averaged 150 psig. Initial attempts at producing cellulose acetate fibers resulted in fibers which exhibited very poor burst strength, less than 25 psig in most cases, and no NaCl rejection with very low salt concentrations. A secondary product of the project was a single fiber testing device which allowed screening of candidate fibers immediately after spinning, without having to wait for a module to be potted. (OSW)

W74-00160

#### HYDROCASTING REVERSE OSMOSIS MEMBRANES, DEVELOPMENT OF POROUS SUPPORT TUBES, STUDY OF MECHANISM OF MEMBRANE FORMATION AND DEVELOPMENT OF NON-CELLULOUS DESALINATION MEMBRANES

Hydronautics, Inc., Laurel, Md.

M. Frommer, A. Gollan, R. Matz, and M. Tulin.

Available from the National Technical Information Service as PB-221-604, \$1.45 in microfiche. Office of Saline Water Research and Development Program Report No. 855, January 1973. 154 p, 50 fig, 22 tab, 42 ref. 14-30-2974.

Descriptors: \*Desalination, \*Reverse Osmosis, Cellulose, \*Porosity, \*Membranes, \*Surface tension, \*Osmosis, \*Permeability.

Identifiers: Cellulose acetate, Hydrocasting, Skinned Membranes, Asymmetric Membranes, Porous support tubes, Tubules.

Section titles include: Hydrocasting cellulose acetate membranes in porous support tubes and porous tubes development; Characterization of cellulosic and non-cellulosic membrane tubules hydrocast in solid tubes; RADII optimization of internally skinned membrane tubules; The mechanism of membrane formation VI: convective flows and large void formation during membrane precipitation; The structure of cellulose acetate membranes the surface tension of polymer solutions; and Preliminary production cost estimate of supported and unsupported hydrocast modules. (OSW)

W74-00161

#### REACTIONS AND TRANSPORT PHENOMENA, AT SURFACES

Oak Ridge National Lab., Tenn.

F. A. Posey, P. M. Lantz, R. E. Meyer, M. C.

Banta, and A. A. Palko.

Available from the National Technical Information Service as PB-221 813, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 853, May 1973. 148 p, 59 fig, 8 tab, 88 ref. 14-01-0001-937.

Descriptors: Electrochemistry, \*Electrodes, \*Instrumentation, Corrosion, Oxygen, Sea water, \*Desalination, \*Surfaces.

Identifiers: \*Transport phenomena (Surfaces), \*Voltammetry, Electroanalysis, Suspension electrodes, Metal pitting, Silver-silver chloride electrodes, Oxygen analysis, Bicarbonate removal, pH-control.

## Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3A—Saline Water Conversion

This report is composed of nine papers: An approximate mass-transport Model for Pitting of Metals; Chronopotentiometry and Voltammetry of the Ag-AgCl Electrode in Flowing Streams, I. Experimental; Chronopotentiometry and Voltammetry of the Ag-AgCl Electrode in Flowing Streams, II. Theoretical; Rapid Batch and Continuous Electroanalysis for the Chloride Ion; Chronopotentiometry of the Silver-Silver Sulfide System; An Electrochemical Method for Monitoring the Oxygen Content of Aqueous Streams at the Part-Per-Billion Level; Properties of the Suspension Electrode; Theory of the Suspension Electrode; and Development of a Device for Pretreatment of Seawater for pH Control and Bicarbonate Removal. (OSW) W74-00162

#### TRANSPORT PROPERTIES OF CHARGE-MOSAIC MEMBRANES-PART A,

Harvard Medical School, Boston, Mass.

J. N. Weinstein, C. R. Gardner, and S. R. Caplan. Available from the National Technical Information Service as PB-223 153, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 864, (October 1972). 48 p, 9 fig, 3 tab. 14-01-0001-2148.

Descriptors: \*Membranes, \*Ion transport, Osmosis, \*Permeability, \*Perselective membranes, Semipermeable membranes, \*Desalination, Films, Thin films, Membrane processes, Pressure, Separation techniques.

Identifiers: Piezodialysis, Pressure dialysis, Nonequilibrium thermodynamic analysis, \*Charge mosaic membranes, Polarization, Hydrodynamic model, Phenomenological coefficients, Concentration polarization.

A nonequilibrium thermodynamic analysis of piezodialysis is presented. For a charge-mosaic membrane in which circulating current constitutes the major contribution to salt flow, it is shown that the 'complete' local phenomenological coefficients are concentration-independent. Hence, upon integration, the flows may be expressed as linear functions of the global forces. The resulting expressions are used to predict the fractional recovery and rate of production of potable water in desalination by piezodialysis. An illustrative calculation is performed for a cylindrical tube (or hollow fiber) made from a hypothetical mosaic membrane whose properties have been calculated from those of Zeo-karb 315 cation exchange membrane. Perfect radial mixing and the absence of concentration polarization are assumed in order to focus attention on the role played by the membrane elements and circulating currents. For a 1 mm thick membrane the calculation shows an 81% recovery of potable water of 350 ppm from a brackish water feed of 1500 ppm, the rate of production being 23 gpd/sq ft. A thinner mosaic with a correspondingly reduced pattern size would give a proportionately higher production rate with no loss in recovery, provided that significant polarization could be prevented. This calculation sets upper limits on the performance of a given membrane by assuming that its properties, rather than the hydrodynamic conditions, are rate controlling. The analysis suggests ways of changing membrane properties to improve performance. (See also W74-00311) (OSW) W74-00310

#### TRANSPORT PROPERTIES OF CHARGE-MOSAIC MEMBRANES - PART B,

Harvard Medical School, Boston, Mass.

J. N. Weinstein, B. J. Bunow, and S. R. Caplan. Available from the National Technical Information Service as PB-223 153, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 864, (October 1972). 103 p, 19 fig, 8 tab. 14-01-0001-2148.

Descriptors: Membranes, \*Ion transport, Osmosis, \*Reverse osmosis, \*Membrane processes,

\*Desalination processes, Separation techniques, Pressure semipermeable membranes, Permeability, Films.

Charge-mosaic membranes are currently being considered for a number of practical applications, most notably 'piezodialysis' desalination. In Part I of this series the properties of the charge-mosaic are subjected to a nonequilibrium thermodynamic analysis, with emphasis on the role of the electrical resistance in the solutions bathing the membrane. Four regimes of operation are delineated by the analysis: (i) membrane control, (ii) solution control, (iii) co-ion leakage control, and (iv) polarization control. The nonequilibrium thermodynamic analysis developed in Part I of this series was subjected to experimental test. Experiments were performed to evaluate a set of six independent transport coefficients characterizing the individual anion and cation exchange elements. The results were used in conjunction with calculated values of the solution conductances to predict the transport properties of the charge-mosaic as a whole. (See also W74-00310) (OSW) W74-00311

#### NEW POLYMER MEMBRANE TECHNOLOGY FOR DESALINATION OF SEAWATER BY REVERSE OSMOSIS,

Union Carbide Corp., Bound Brook, N.J.

L. A. Pilato, L. M. Litz, J. E. McGrath, R. N. Johnson, and I. E. Kochevar.

Available from the National Technical Information Service as PB-222 996, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 867, March 1973. 40 p, 1 fig, 16 tab. 14-30-2985.

Descriptors: \*Reverse osmosis, \*Membranes, \*Desalination, \*Perselective membranes, Seawater, Saline water, Demineralization, Semipermeable membranes, Absorption, Pressure.

Identifiers: Hydrophilic heterocyclic monomers, Polysulfone, Poly (aryl ethers), Ethoxylation of Nylon 6, Water sorption.

The modification of poly (aryl ethers) by incorporation of heterocyclic hydrophilic monomers or amide containing monomers has improved their water uptake to values of 3-5% when compared to 0.69% for polysulfone, an unmodified poly (aryl ether). Attempts to increase the water sorption of the novel amide containing poly (aryl ethers) by ethoxylation were unsuccessful. Low water fluxes  $1 \times 0.0001 \text{ gal/sq ft-day}$  (GFD) under reverse osmosis conditions (0.1% NaCl at 1500 psi) were generally observed for all novel poly (aryl ethers). Model studies designed to improve the reverse osmosis behavior of polyamides were conducted with nylon 6. Ethoxylated nylon 6's with ethylene oxide contents ranging from 1.4 - 6.5% afforded fluxes ranging from 0.3 - 1.7  $\text{gal/sq ft-day}$  (GFD) and salt rejections ranging from 44-90%. Characterization of these systems indicated that polymer crystallinity decreased with increasing ethylene oxide content. Ethoxylation of Trogamid T, an amorphous alkyl polyamide, to levels up to 6% ethylene oxide afforded materials with low water flux. Ethoxylation of an aryl polyamide significantly increased water flux, but decreased salt rejection. (OSW) W74-00312

#### FABRICATION AND TESTING OF TUBULAR REVERSE OSMOSIS MODULES CONTAINING ULTRATHIN MEMBRANES FOR WET-DRY CYCLING OPERATIONS,

North Star Research and Development Inst., Minneapolis, Minn.

For primary bibliographic entry see Field 05F.

W74-00313

#### DEVELOPMENT OF HIGH-FLUX HOLLOW REVERSE OSMOSIS FIBERS FOR BRACKISH WATER SOFTENING,

Monsanto Research Corp., Durham, N.C.

R. L. Leonard.

Available from the National Technical Information Service as PB-223 102, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 872, September 1973. 52 p, 8 fig, 21 tab, 4 ref. 14-30-3066.

Descriptors: \*Membrane processes, \*Desalination processes, Desalination, \*Reverse osmosis, \*Water treatment, \*Water softening, Pilot plants, Brackish water.

Identifiers: Hollow fine fiber modules, Cellulose acetate membranes.

This study involved additional development of asymmetric cellulose acetate hollow fibers and resulted in a brackish water desalting system for hardness removal and partial demineralization exhibiting fluxes of 8.5 gfd at 100 psig operating pressure. The fiber systems tested showed good stability with flux declines of less than one percent after 100 days of continuous operation. Two modules, an axial-flow and radial-flow unit, each in excess of 5000 gpd capacity were assembled and field tested on Webster, So. Dakota feedwater. The radial design unit, a six-inch diameter module with four-foot active length, produced 6000 gpd (70 deg F) with salt rejection of 92%, at 100 psig operating pressure. Design and construction work was also carried out on a third modular concept, the fiber bobbin cartridge, but this was not carried through to evaluation of a functional unit. (OSW) W74-00314

#### RESEARCH ON COMPOSITE HOLLOW TUBULES,

DeBell and Richardson, Inc., Enfield, Conn.

B. Baum, R. A. White, H. Stiskin, and W. H. Holley, Jr.

Available from the National Technical Information Service as PB-222 977, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 865, March 1972. 88 p, 14 fig, 27 tab, 10 ref. 14-30-2784.

Descriptors: \*Reverse osmosis, \*Membranes, \*Desalination, \*Perselective membranes, Brackish water, Pressure, Semipermeable membranes, Permeability, Coatings.

Identifiers: \*Polyvinyl chloride tubules, Porous supports, Asymmetric cellulose acetate, Ultrathin film barriers, Dynamically formed membranes, Polyacrylic acid membranes, Polyvinyl chloride films, Ultrathin polyethyleneimine/toluene diisooxyane films.

The work has consisted of preparing porous tubules, 0.030-0.060 inch diameter, and coating the outside of the tubules with reverse osmosis permeable barriers. Asymmetric cellulose acetate E-400-25 dissolved in formamide-acetone is the most promising coating, yielding very consistent results even when handled roughly. Initial results with this system were low in flux but this problem was solved by using more dilute cellulose acetate casting solutions. Tubule fluxes of 14 to 15 gfd at 800 psi and 1% NaCl were readily attainable. Salt rejections were 95-98%. Initial work with the dynamically formed membranes from zirconium oxide and polyacrylic acid showed promise (6-18 gfd at 94 to 98% sodium sulfate rejection and 80-94% sodium chloride rejection at 950 psi). Preliminary work was carried out to develop a polysulfonic-zirconium oxide membrane which should be more resistant to fouling by divalent ions. Initial membranes gave low salt rejections (80%) but the system deserves further investigation. These dynamically formed systems have the advantage of in situ coating of the tubules in the module. Work with ultrathin cellulose acetate, sulfonated PPO, polyethyleneimine-TDI, and polyacrylic acid coated directly on the porous tubule with and

## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

### Use of Water of Impaired Quality—Group 3C

without pore fillers gave only 0-40% rejection. Apparently the pore size is too large. A finer (0.05 micro) pore PVC formulation was developed but the fine pore uncoated PVC did not permit water flux at pressures much below 800 psi. (OSW) W74-00315

**RESEARCH ON REVERSE OSMOSIS MEMBRANES FOR PURIFICATION OF WASH WATER AT STERILIZATION (165 DEG F),**  
General Electric Co., Lynn, Mass.  
For primary bibliographic entry see Field 05D.  
W74-00316

**RESEARCH ON COMPOSITE HOLLOW TUBULETS,**  
DeBell and Richardson, Inc., Enfield, Conn.  
B. Baum, R. A. White, W. H. Holley, Jr., and H. Stiskin.

Available from the National Technical Information Service as PB-222 978, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 868, March 1973. 86 p, 16 fig, 32 tab, 5 ref. 14-30-2784.

Descriptors: \*Reverse osmosis, \*Membranes, \*Permeselective membranes, \*Semipermeable membranes, \*Desalination apparatus, Filtration, Plastics, Thin films, Pressure, Desalination.  
Identifiers: \*Porous PVC Tubulets, Cellulose acetate coating, Tubulet bundles.

Formulation and methods for preparing porous 0.027 inch OD tubulets at extrusion rates of 200 feet/minute were perfected. Methods for coating long lengths of tubulet with uniform, flaw-free asymmetric cellulose diacetate were developed. A bundle permeator was assembled and potted. The permeator characteristics with 515 psi, 0.5% NaCl are Flux - 15.9 gal/day, 10 gft<sup>2</sup>, Salt Rejection - 95.8%, Flux/volume - 10,970 gal/day/cu. ft. Work with coating systems other than asymmetric cellulose diacetate was carried out but these alternate systems were not developed as far as would be needed to prepare a bundle permeator. (OSW) W74-00317

**RESEARCH ON ADVANCED MEMBRANES FOR REVERSE OSMOSIS,**  
Envirogenics Co., El Monte, Calif.  
A. F. Graefe, W. J. Schell, C. W. Saltonstall, Jr., V. T. Stannett, and H. B. Hopfenberg.  
Available from the National Technical Information Service as PB-223 008, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 870, March 1973. 55 p, 15 fig, 14 tab, 16 ref. 14-30-2999.

Descriptors: \*Reverse osmosis, \*Membranes, \*Semipermeable membranes, Sea water, Permeselective membranes, Semipermeable membranes, Permeability, \*Desalination.  
Identifiers: Polysulfone, Sulfonated polysulfones, Composite membranes, Asymmetric membranes, Polyoxetanes.

One of the objectives was that of preparing new noncellulosic polymers for asymmetric membrane fabrication that exhibit intrinsic chemical and reverse-osmosis transport properties superior to those of cellulose acetate. Those polymers containing ether and sulfone groups appeared to be the most promising; accordingly, attention was directed to the evaluation of modified polysulfones and polyoxetanes. With respect to asymmetric membranes it was found that sulfonation of Bakelite polysulfone (Union Carbide, P1700) yielded a product possessing intrinsic osmotic properties superior to those of cellulose acetate. Dense films of sulfonated polysulfone exhibited rejections of 35,000 ppm sodium chloride as high as 99.6% at 1500 psig. The development of asymmetric membranes from sulfonated polysulfone resulted in sodium chloride rejections greater than

91% with a flux of 27.5 gfd at 400 psig. Fluxes as high as 66 gfd were achieved with sodium sulfate at 400 psig with a rejection of 95.6%. Studies of composite membranes found that poly (2-methyl-5-vinyl) pyridine deposited on tubular polysulfone support membranes exhibited greater than 30 gfd flux and 40% rejection with 1000 ppm magnesium sulfate at 400 psig. An investigation was made relating to the modification of Penton, in film form, through the radiation grafting of selected hydrophilic monomers. Successful grafting was achieved with styrene, methyl methacrylate, and 2-vinyl pyridine. (OSW) W74-00318

**DESIGN INTEGRITY AND PERFORMANCE CHARACTERISTICS OF HELICAL TUBULAR MODULE ELEMENTS IN REVERSE OSMOSIS PLANTS,**

Philco-Ford Corp., Newport Beach, Calif.  
R. H. Williams, G. Segovia, W. H. Bachle, J. C. Britt, and J. L. Richardson.

Available from the National Technical Information Service as PB-223 119, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 871, September 1973. 83 p, 28 fig, 17 tab, 4 ref. 14-30-2740.

Descriptors: \*Desalination, Desalination processes, \*Reverse osmosis, \*Membrane processes, \*Pilot plants, Brackish water.

Identifiers: Helical tubular module elements, Field evaluation testing.

A brackish water desalting reverse osmosis pilot plant incorporating 36 series-connected helical tubular segments, each formed from a one inch diameter, 50 foot long tubular membrane was designed and fabricated. The membrane permeability was varied from the system inlet to outlet in a predetermined manner in order to enhance overall system performance. Individual membrane segments were subjected to laboratory tests with 5000 ppm NaCl and 2000 ppm Na<sub>2</sub>SO<sub>4</sub> test solutions to establish (a) effects of inlet pressure, temperature and velocity on performance; (b) membrane compaction rates, burst pressures, and frictional pressure drop; and (c) effects of negative pressures and pressure cycling. The assembled pilot plant was tested in the laboratory to verify design, integrity and performance at various operating pressures, fractional recoveries and feedwater velocities. Subsequently, the pilot plant was installed and operated at the OSW Brackish Water Test Facility at Roswell, New Mexico. A sixty day qualification test period was successfully completed on July 6, 1972. (OSW) W74-00319

**DEFINITION OF REVERSE OSMOSIS REQUIREMENTS FOR SPACECRAFT WASH WATER RECYCLING,**

McDonnell Douglas Astronautics Co.-West, Huntington Beach, Calif.

For primary bibliographic entry see Field 05D.  
W74-00320

**HYGIENIC EVALUATION OF THE QUALITY OF WATER OBTAINED BY MEANS OF ELECTRODIALYSIS DESALTING OF IMITATION SEA WATER, (IN RUSSIAN),**  
Nauchno-Issledovatel'skii Institut Gigiency, Moscow (USSR).

A. F. Aksyuk, Yu. V. Novikov, Z. A. Anisimova, T. K. Parkhomchuk, and E. F. Gorshkova.  
Gig Sanit. Vol 37, No 4, p 19-23. 1972. Illus. (English summary).

Identifiers: \*Electro dialysis, \*Hygienic aspects, Imitation, Rat, Water quality, Sea water, \*Desalination.

Complex hygienic investigations showed that water desalinated using electrodialysis without special treatment caused changes of the mineral

metabolism in organs and tissues, disturbances in nervous system activity and pathohistological lesions of internal organs in albino rats.—Copyright 1973, Biological Abstracts, Inc.

W74-00478

### 3B. Water Yield Improvement

**RULES, REGULATIONS AND MODES OF PROCEDURE, RELATING TO THE TEXAS WEATHER MODIFICATION ACT, V.A.T.S. WATER CODE, CHAPTER 14.**

Texas Water Development Board, Austin.

Report, April 1973. 33 p.

Descriptors: \*Weather modification, \*Legal aspects, \*Texas, Permits, Regulation, State governments, Legal review, Water law, Penalties (Legal), Adjudication procedure, Administrative agencies, Decision making.  
Identifiers: Hearing panel.

Rules, regulations and modes of procedure relating to the Texas Weather Modification Act, V.A.T.S. Water Code, Chapter 14, as amended March 20, 1973, are presented. The rules are adopted for the purpose of promoting continued research and development in the science and technology of weather modification, minimizing the danger of weather modification activities to health and property, simplifying procedures, avoiding delays, saving expenses, and facilitating administration and enforcement of Chapter 14 (Weather Modification) of the Texas Water Code, and these rules shall be construed accordingly. (Woodard-USGS)  
W74-00357

**EVAPORATION RETARDATION BY MONOMOLECULAR LAYERS,**  
Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.  
Y. S. Lou, and G. P. Rasmussen.  
Water Resources Research, Vol 9, No 5, p 1258-1263, October 1973. 2 fig, 14 ref.

Descriptors: \*Evaporation control, \*Monomolecular films, \*Reservoir evaporation, Mathematical studies, Mass transfer, Diffusion, Water temperature.

An analytical theory based on the kinetic theory of discrete particles describes the movement of water molecules through a monolayer. A simplified model based on the theory shows the rate of evaporation through a monolayer to be a function of the length of the hydrocarbon chain molecules, the arrangement of the monolayer molecules, the thickness of the surface diffusion sublayer, and the temperature of the water. (Knapp-USGS)  
W74-00373

### 3C. Use of Water of Impaired Quality

**SALINITY STUDIES IN EAST GLADES AGRICULTURAL AREA, SOUTHEASTERN DADA COUNTY, FLORIDA,**  
Geological Survey, Tallahassee, Fla.

J. E. Hull, and F. W. Meyer.

Open-file Report 73005, 1973. 84 p, 20 fig, 2 tab, 18 ref.

Descriptors: \*Salinity, \*Surface waters, \*Groundwater, \*Florida, Agriculture, Hydrologic data, Land use, Groundwater movement, Water levels, Saline water intrusion, Topography, Streams, Canals, Soils, Saline soils, Water analysis, Chemical analysis, Aquifer characteristics, Chlorides, Data collections, Forecasting.  
Identifiers: \*Dade County (Fla.).

## Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3C—Use of Water of Impaired Quality

Investigations were made in southeastern Dade County, Florida, to determine the source of salts in the soil and the process by which the salts accumulate. Saline soils in the East Glades agricultural area are caused chiefly by brackish groundwater moving upward from the water table during dry periods. Brackish groundwater is caused by infiltration of saltwater from nearby coast-normal canals and by inland movement of saltwater through the deep parts of the Biscayne aquifer during droughts. The soils most prone to salt accumulation generally occur within the area affected by sea-water intrusion. The outlook for the East Glades is for no improvement in saline soil problems unless land use changes permit higher water levels along the coast to halt the inland movement of seawater. (Woodard-USGS)  
W74-00329

**CROP YIELDS FROM LAND RECEIVING LARGE MANURE APPLICATIONS,**  
Texas A and M Univ., College Station.  
D. L. Reddell, P. J. Lyrly, and J. J. Hefner.  
Paper No 72-960 presented at 1972 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 11-15, 1972. 14 p, 2 fig, 7 tab, 9 ref.

Descriptors: Application methods, \*Cultivation, \*Crop yield, Nitrates, Forage, Salinity, \*Farm wastes, Cattle, \*Waste disposal, Texas, Ground water, Irrigation, Aquifer, \*Fertilizers, Moisture content, Nutrients.

The objectives were to evaluate the pollution and crop growth due to deep plowing large amounts of beef manure. Two problems faced by feed lot operators have been finding sufficient land on which to use large quantities of feed lot waste and contending with the excessive salinity of such waste. Three locations with Hoban silty clay loam, and Vinton fine sandy loam were used and graduated amounts of waste up to 900 tons per acre were applied at depths of 14 to 36 inches. Rates of application and nitrate contents of crops yielded are recorded. Results show peak yield and nitrate composition of crops to be on those acres with 25 and 50 tons of farm waste. In all locations acres with 900 tons per acre yielded more than the check plot (0 tons per acre). Those most heavily laden plots presented no major surface water pollution problem. (Frantz-East Central)  
W74-00425

**EFFECTS OF SWINE LAGOON EFFLUENT ON THE SOIL AND PLANT TISSUE,**  
Iowa State Univ., Ames. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 05D.  
W74-00428

### 3D. Conservation in Domestic and Municipal Use

**METHODOLOGY FOR ASSESSING THE POTENTIAL IMPACT OF URBAN DEVELOPMENT ON URBAN RUNOFF AND THE RELATIVE EFFICIENCY OF RUNOFF CONTROL ALTERNATIVES,**  
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.  
For primary bibliographic entry see Field 02A.  
W74-00001

**STUDIES IN THE ANALYSIS OF METROPOLITAN WATER RESOURCES SYSTEMS, VOL. VI ESTIMATING ECONOMIES OF SCALE IN THERMAL ELECTRIC POWER SYSTEMS SUBJECT TO ENVIRONMENTAL QUALITY CONSTRAINTS,**  
Cornell Univ., Ithaca, N.Y.  
For primary bibliographic entry see Field 06B.  
W74-00002

**INTERACTION OF BULK PRECIPITATION, STREAM WATER, AND SEWAGE IN A SMALL WATERSHED NEAR OXFORD, MISSISSIPPI,**  
Mississippi Univ., University. Dept. of Geology and Geological Engineering.

For primary bibliographic entry see Field 02A.  
W74-00005

**WATER USE--COMMITTEE REPORT, PART II, REVIEW OF THE JOHNS HOPKINS UNIVERSITY RESEARCH PROJECT METHOD FOR ESTIMATING RESIDENTIAL WATER USE.**  
American Water Works Association, New York. Committee on Water Use.

For primary bibliographic entry see Field 06D.  
W74-00121

**ENGINEERING ALTERNATIVES IN NATURAL RESOURCES DEVELOPMENT IN URBAN REGIONS,**  
Philadelphia Water Dept., Pa.

For primary bibliographic entry see Field 05D.  
W74-00122

**ROLE OF DIGITAL COMPUTER MODELS OF AQUIFERS IN WATER RESOURCES PLANNING: CASE STUDY IN TUCSON, ARIZONA,**  
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.

For primary bibliographic entry see Field 04B.  
W74-00176

**RELIABILITY OF URBAN WATER QUALITY MANAGEMENT,**  
Texas A and M Univ., College Station. Dept. of Industrial Engineering.

For primary bibliographic entry see Field 05G.  
W74-00180

**NEED FOR METROPOLITAN WATER BALANCE INVENTORIES,**  
American Society of Civil Engineers, Marblehead, Mass. Urban Water Resources Research Program.

For primary bibliographic entry see Field 06A.  
W74-00187

**ECONOMIC ANALYSIS AND MUNICIPAL WATER SUPPLY IN DEVELOPING COUNTRIES,**  
International Bank for Reconstruction and Development, Washington, D.C.

For primary bibliographic entry see Field 10A.  
W74-00190

**TOXIC MATERIALS ANALYSIS OF STREET SURFACE CONTAMINANTS,**  
URS Research Co., San Mateo, Calif.

For primary bibliographic entry see Field 05B.  
W74-00306

**GROUND WATER RECHARGE, SOUTHERN REGIONAL DISTRICT, MONTGOMERY COUNTY, OHIO, ENGINEERING STUDY AND REPORT, PHASE I.**

Moulbent and Seifert, Dayton, Ohio.  
For primary bibliographic entry see Field 04B.  
W74-00439

**REPORT TO THE GOVERNOR AND THE INTERIM FINANCE COMMITTEE: ALTERNATIVE RECOMMENDATION, LAS VEGAS WASH/BAY POLLUTION ABATEMENT PROJECT.**

Clark County Board of County Commissioners, Nev.  
For primary bibliographic entry see Field 05D.  
W74-00440

**FROM RESORT AREA TO URBAN RECREATION CENTER: THEMES IN THE DEVELOPMENT OF LAKE TAHOE 1946-1956,**  
California Univ., Davis. Inst. of Governmental Affairs.

For primary bibliographic entry see Field 06B.  
W74-00441

**DEMOGRAPHIC EFFECTS OF WATER DEVELOPMENT,**  
For primary bibliographic entry see Field 06D.  
W74-00443

**WATER DEVELOPMENT AND URBAN RECREATION,**  
For primary bibliographic entry see Field 06B.  
W74-00446

#### SOLID WASTE MANAGEMENT.

Metropolitan Council of the Twin Cities Area, Minn.  
For primary bibliographic entry see Field 05G.  
W74-00449

**METROPOLITAN COUNCIL FIVE-YEAR CAPITAL IMPROVEMENT PROGRAM FOR SEWERAGE FACILITIES.**

Metropolitan Council of the Twin Cities Areas, Minn.  
For primary bibliographic entry see Field 05G.  
W74-00450

**METROPOLITAN DEVELOPMENT GUIDE, WATER RESOURCES POLICY PLAN, PROGRAM.**

Metropolitan Council of the Twin Cities Area, Minn.  
For primary bibliographic entry see Field 06B.  
W74-00451

**SEWAGE AND WASTE CONTROL RULES AND REGULATIONS FOR THE METROPOLITAN DISPOSAL SYSTEM.**

Metropolitan Sewer Board, St. Paul, Minn.  
For primary bibliographic entry see Field 05G.  
W74-00452

**COMPREHENSIVE PLAN FOR BATON ROUGE.**

Baton Rouge City-Parish Planning Commission, La.

June, 1972. 113 p, 5 fig, photos, 20 maps, 21 tab.

Descriptors: \*Comprehensive planning, \*Land use, \*Flood plains, \*Louisiana, Urbanization, Drainage, Environmental effects, Flood plain zoning, Canals, Sewerage, Projections, Implementation, \*Cities.

Identifiers: \*Land use plan, Flood plain management, \*Baton Rouge, Utility extension policies.

The purpose is to help guide urban development in East Baton Rouge Parish where the present population of 300,000 is expected to reach 425,000 during the planning period of 15 to 20 years. The emphasis is on relating urban land uses to various determinants such as the natural environment, economic growth, social considerations, and population growth and then proposing a general land use plan as a guide for future development. Some key elements of the plan, particularly in terms of implementation are the expansion of transportation, recreation, and sewerage systems in accordance with planned priorities, the delineation and restricted use of flood plain and conservation areas, and the reformulation of zoning policies and principles. Surface water drainage is a crucial element in land use planning in Baton Rouge Parish as the annual rainfall is about 60 inches. Drainage canals are widely used to drain

## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

### Conservation in Agriculture—Group 3F

residential areas and relieve flooding conditions. However, it is also necessary to deter future urban development from flood plain areas. Efforts are now being directed toward adopting a flood plain zoning regulation and other management measures. (Elfers-North Carolina)  
W74-00453

#### NATURAL ENVIRONMENTAL ANALYSIS, NASHVILLE-DAVIDSON COUNTY, TENNESSEE.

Metropolitan Government of Nashville-Davidson County, Tenn. Planning Commission.

August, 1973. 125 p, 15 fig, photos, 11 maps, 9 tab, 61 ref.

Descriptors: \*Environmental effects, \*Urbanization, Slopes, Watersheds (Basins), Soils, Geology, Tennessee, Cities.

Identifiers: \*Environmental analysis, Highland Rim Escarpment, Cumberland River, J. Percy Priest Reservoir, \*Nashville (Tenn.).

Components of natural environment are identified and analyzed with regard to limitations for development, and the relationship between conservation and urban development for Davidson County is explored. In discussion of the county's hydrology micro-watershed areas of the Cumberland River are identified and classified by general physical characteristics. Cheatham Reservoir (Cumberland River) and Old Hickory Dam effect flood control conservation and recreational opportunities. Old Hickory Dam also provides hydroelectric power for the general area. Construction of J. Percy Priest Reservoir in 1970 containing approximately 14,200 water acres on Stones River lowered the average elevation in the county susceptible to flooding from 420 ft. to 412 ft. above sea level. Extensive land areas around the reservoir insure high degree of water quality and environmental control. Large recreation areas are under construction. Development in flood plains is increasing. Devices to control flooding are considered. Emphasis should be placed on a balance between structural and regulatory controls. Regulations should prohibit certain uses in parts of flood plain most susceptible to flood losses. The value of the Cumberland River to provide a natural corridor through the urban area and the development of the Harpeth River and Mill Creek watersheds as urbanization increases and flood problems multiply is discussed. Ground water from 8% of county wells yield enough water for commercial, light industrial and home use. A need for new land development regulations and strategy for public and private action are expressed. (Stein-North Carolina)  
W74-00455

#### CENTRAL FRESNO COUNTY WATER AND LIQUID WASTE PROGRAM: VOLUME I-FINDINGS, CONCLUSIONS, RECOMMENDATIONS.

Grunwald, Crawford and Associates, Inc., Fresno, Calif.; and Engineering-Science, Inc., Fresno, Calif.

Prepared for Board of Supervisors, Fresno County, California. March, 1970. 127 p, 22 fig, 33 tab, appendix. HUD Calif. P-308.

Descriptors: \*Planning, \*Water supply, \*Sewerage, \*Groundwater, Urbanization, Water demands, Computer models, Coordination, Management, \*California.

Identifiers: \*Fresno County (Calif), San-Joaquin Valley Region.

This report is the first part of a five volume, comprehensive study of planning for water supply and wastewater disposal in a 410 square mile area of Fresno County, which includes Fresno, Clovis, Fowler, Kingsburg, and Selma plus adjacent

agricultural lands. Basically a summary of the entire study, this volume includes short presentations on urban development patterns, projected demands for 3 periods: short-range (1975), mid-range (1985), and long-range (2015), FUTURE PROBLEMS, RECOMMENDED DEVELOPMENT PROGRAMS, FINANCING, AND INTERGOVERNMENTAL APPROACHES. Population is expected to triple by 1015. Food products manufacturing will continue to be the largest manufacturing industry in the County. Significant future shifts in the top five employment categories are projected with agricultural workers being replaced by those in the professional services, while retail trade and manufacturing remain relatively stable. Of particular interest is the Fresno Groundwater Basin, a 1,200 square mile hydrologic unit including Fresno County, and the development of a computer model to evaluate effects of future urban land use. Some of the recommendations include the consolidation of twelve local sewerage systems into two regional ones, the comprehensive management of the entire Fresno Groundwater Basin, the use of surface water in addition to the groundwater supplies, and the use of joint agreements rather than a regional agency. Numerous maps and charts supplement the text. (Elfers-North Carolina)  
W74-00457

#### PRELIMINARY REPORT OF PUBLIC UTILITIES ANALYSIS.

Janesville Div. of Public Works, Wis.

April, 1972. 65 p, 14 fig, 11 tab.

Descriptors: \*Planning, \*Water supply, \*Sewerage, \*Drainage systems, Wells, \*Wisconsin, Projections, Urbanization, Land use, Groundwater.

Identifiers: \*Utility system expansion, \*Janesville (Wis.), Rock River, Drainage greenbelts.

The existing water supply, sanitary sewerage, and storm water disposal systems for Janesville, some of the problems involved in their operation and possible expansion, and population and land use projections requiring system expansion, several courses of action are proposed for improvement of the systems are described. The water supply system uses both deep and shallow wells and emphasis for future growth is on extension of new water lines, development of a few new well sites, and the protection of groundwater recharge northeast of the city. The sanitary sewerage system is presently adequate except for one overloaded trunk line; a relief sewer line is proposed to run parallel to the overloaded one. The overall system is to be expanded in accordance with urban growth control policies. The storm sewer system consists largely of natural greenbelt drainage ways which are required to be dedicated to the city by developers. This greenbelt dedication policy is encouraged to be continued along with the policy of discharging stormwater to the land rather than directly to the Rock River whenever possible. (Elfers-North Carolina)  
W74-00458

### 3E. Conservation in Industry

#### GLUE TREATMENT-PICK A WAY.

Calspan Corp., Buffalo, N.Y.  
For primary bibliographic entry see Field 05D.  
W74-00165

A FUNDAMENTAL COMPARISON OF THE UTILITY OF TRICHLOROETHYLENE AND PERCHLOROETHYLENE IN THE APPLICATION OF DISPERSE DYES TO POLYESTER, Auburn Univ., Ala. Water Resources Research Inst. W. S. Perkins, and D. M. Hall.

In: Proceedings, Textile Solvent Technology—Update '73, Atlanta, Georgia, January 10-11, 1973. p 49-57, (1973). 13 fig, 7 tab, 10 ref, (Amer. Assoc. of Chemists and Colonists Symposium). OWRR A-020-ALA (2).

Descriptors: \*Textiles, \*Solvents, \*Dyes, Sorption.

Identifiers: \*Polyester, Trichloroethylene, Perchloroethylene, Partition coefficients.

Polyester may be rapidly dyed with selected Disperse dyes from trichloroethylene and perchloroethylene. The rate of sorption of dye by polyester is much greater from both of these solvents than from aqueous medium. Further, the rate of sorption increases greatly with increasing temperature in each solvent. A higher dyeing temperature is required to achieve as rapid rate of sorption of dye from perchloroethylene as from trichloroethylene. The equilibrium sorption of dye decreases with increasing temperature in all cases studied. Partition coefficients of each of the dyes studied are higher from perchloroethylene than from trichloroethylene. The equilibrium sorption of dye by polyester from trichloroethylene and perchloroethylene is dependent on the polarity of the dye molecule with more polar dyes in this study giving higher partition coefficients.  
W74-00433

### 3F. Conservation in Agriculture

#### INTENSITY OF PLANT TRANSPERSION IN CERTAIN VARIETIES AND MUTANT FORMS OF COTTON, (IN RUSSIAN), Akademiya Nauk Tadzhikskoi SSR, Dushanbe. Institut Pochvovedeniya.

B. Akhmedov.

Izv Akad Nauk Tadzh SSR Otd Biol Nauk. 1. p 11-14. 1972. Illus.

Identifiers: \*Cotton, Flowering, Mutant plants, \*Transpiration, \*USSR (Tashkent).

The water regime was studied in cotton cultivars 108-F, C-4727, 2421, and mutant No. 1 fr "Tashkent, mutants No. 1 and 2 obtained at the Institute of Plant Physiology and Bio-physics of the Academy of Science of the Tadzhik SSR, and mutant from Azerbaijan. Mutant forms of 108-F and 2421 had more intense transpiration than the original forms during the early stages of development. In the later stages of transpiration, differences in transpiration were not observed. In all plants studied, transpiration was highest during the period of massive flowering and fruit formation. In general, transpiration increased from morning until midday, and then decreased.—Copyright 1973, Biological Abstracts, Inc.  
W74-00026

#### RELATIONSHIP BETWEEN PROPERTIES AND AGRICULTURAL SUITABILITY OF SOILS: SOIL COMPLEXES: GOOD WHEAT SOILS, VERY GOOD RYE SOILS, GOOD RYE SOILS (IN POLISH),

Instytut Uprawy Nowozenia i Gleboznawstwa, Pulawy (Poland). Laboratorium Anal. Glebowych. For primary bibliographic entry see Field 02G.  
W74-00054

CONTRIBUTION TO THE KNOWLEDGE OF MINERAL NITROGEN DYNAMICS IN A GREY FERRUGINOUS SOIL AT NIORO-DU-RIP (SENEGAL), (IN FRENCH), Centre National de Recherches Agronomiques de Bamby (Senegal). D. Blondel.

Agron Trop Ser Agron Gen Etud Sci. Vol 26, No 12, p 1354-1361, 1971. Illus. English summary.

Identifiers: Fertilizers, \*Minerals, \*Nitrogen, \*Senegal, Sorghum, \*Soils (Grey ferruginous).

## Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3F—Conservation in Agriculture

The dynamics of mineral N as nitrate and ammonium was studied in the field in a design of bare plots and plots under sorghum with or without nitrogenous fertilizer applications. Samples were taken every 10 cm from the surface down to 1 m deep during the 1969 rainy season (900 mm in 4 mo.). Compared with the soils at Bambe and Sefo (Senegal), the N dynamics show 2 characteristics. No mineralization peak is observed at the beginning of the rainy season and the nitrogenous fertilizer stimulates the mineralization of N in the soil. Copyright 1973, Biological Abstracts, Inc.

W74-00062

**WATER RESOURCE DEVELOPMENT PROBLEMS IN A RURAL AREA IN TRANSITION,**  
Montana State Univ., Bozeman. Dept. of Agricultural Economics.  
For primary bibliographic entry see Field 06A.  
W74-00173

**AGRICULTURAL WATER ALLOCATION, LAND USE, AND POLICY,**  
Iowa State Univ., Ames. Center for Agricultural and Rural Development.  
E. O. Heady, H. C. Madsen, K. J. Nicol, and S. H. Hargrove.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 99, No HY10, Proceedings paper No 10074, p 1795-1812, October 1973. 7 fig, 2 tab, 9 ref.

Descriptors: \*Agriculture, \*Water demand, \*Linear programming, \*Water allocation (Policy), \*Water supply, \*Forecasting, \*Land use, Zoning, Hydraulics, Optimization, Water costs, Pricing, Irrigation water, Farm management, Estimating, Technology, Equations, Systems analysis, Mathematical models.  
Identifiers: Federal-state cooperation, Policy, Western States.

A study is reported which used linear programming models to determine optimal water and land allocation and agricultural water needs in the year 2000 under alternative conditions of population, farm policies, exports, technology, and water prices. Fundamentally, the study represents an attempt to estimate whether there is enough water to allow the nation's future food needs to be met at reasonable actual costs by the year 2000. Since this proved possible, the amount of water needed (potential demand) in agriculture was then estimated under the several alternatives, thus also indicating the amount that could be freed from the farm sector for use elsewhere. The linear programming models used encompass U. S. agriculture in its entirety, and all of the commodities and land and water use so involved. These water demand-allocation models include variables and equations for 223 agricultural producing regions, and water resources for 51 supply regions in the 17 Western States and 27 consumer markets. The amount of water used in agriculture is partly a function of the costs of water for irrigation purposes. Thus, an auxiliary objective of the study was formulation of the models so that the demand for water under different pricing policies would be reflected (normatively). The models and results are described in detail. (Bell-Cornell)

W74-00186

**THE ROLE OF THE INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE IN THE TRANSFER OF WATER RESOURCES KNOWLEDGE,**  
Bureau of Reclamation, Denver, Colo. Technical Services Branch.  
For primary bibliographic entry see Field 10A.  
W74-00199

**METHODS OF TRANSFER OF WATER RESOURCES KNOWLEDGE FROM DEVELOPED TO DEVELOPING REGIONS WITH SPECIAL EMPHASIS TO ON-FARM WATER MANAGEMENT,**  
Agency for International Development, Washington, D.C. Office of Agriculture and Fisheries.  
For primary bibliographic entry see Field 10A.  
W74-00219

**SOME CHARACTERISTICS OF NECTAR PRODUCTION IN THE MOUNTAIN HONEY PLANTS OF NORTHERN FERGANA (IN RUSSIAN),**  
Yu. S. Lyovn.  
Byull Mosk O-Va Ispyt Prir Otd Biol, Vol 77, No 2, p 118-124, 1972. English summary.  
Identifiers: Air temperature, Altitude, \*Honey plants, Moisture, Mountain plants, \*Nectar, Precipitation, Seasonal, Soil, \*USSR (Fergana).

The nectar productivity of N. Fergana, USSR honey plants depends on air temperature during the mesothermic season and on air temperature, and relative air humidity, soil moisture and atmospheric precipitation during the xerothermic season. The nectar productivity of honey plants increases with altitude during the xerothermic season, but decreases again at the upper limit of their range. During the mesothermic season it is higher on slopes of southern exposition. Copyright 1973, Biological Abstracts, Inc.  
W74-00235

**EFFECT OF AGRICULTURAL MANAGEMENT OF WET SLOPING SOIL ON NITRATE AND PHOSPHORUS IN SURFACE AND SUBSURFACE WATER,**  
Agricultural Research Service, Burlington, Vt. New England Watershed Research Center.  
For primary bibliographic entry see Field 05B.  
W74-00371

**RELATIONS BETWEEN HOST PLANTS AND PHENOLOGY OF THE GALL MIDGE CONTARINIA TRITICI (KIRBY) AND SITODIPLOPSIS MOSELLANA (GEH.), (IN GERMAN),**  
Biologische Bundesanstalt, Kiel (West Germany). Institut fuer Getreide-, Oelfrucht-, und Futterpflanzenk. T. Basedow.  
Z Angew Entomol. Vol 71, No 4, p 359-367. 1972. Illus. (English summary).  
Identifiers: Agropyron-Repens, \*Contarinia tritici, \*Germany, Host plants, \*Midges, Moisture, Oviposition, \*Phenology, Plant population, Rain, Rye, \*Sitodiplosis-Mosellana, Soil, Temperature, \*Wheat.

The phenological differences between C. tritici and S. mosellana are shown under exact conditions in the laboratory. The existence of a 2nd generation of C. tritici could not be confirmed by investigations in the field. Temperature, rain, and soil moisture influence the course of the wheat blossom midges flights. The effect of the wheat blossom midges best known host plants, i.e., wheat, rye and couch grass (Agropyron repens) on the population dynamics of the 2 spp. in Germany is examined. Rye is scarcely attacked by S. mosellana in wheat growing areas with a small portion of rye grown in it. But in some areas of the Weser-Ems territory, where only rye is grown, the phenology of S. mosellana was adapted to the early blossoming of rye, as shown by laboratory rearing. Winter wheat and spring wheat usually are attacked in the same degree by S. mosellana. Midges that emerge when wheat has finished blossoming, oviposit on wheat ears appearing very late, and on couch grass. The maximum flight of C. tritici is correlated relatively to the time of appearance of the wheat ears. Early varieties of spring wheat do not safely escape the attack by C. tritici. For this midge, too, the wheat ears appear-

ing very late and couch grass are a reservoir of host plants. Copyright 1973, Biological Abstracts, Inc.  
W74-00388

**EFFECTS OF SOME SOIL CONDITIONS ON SUGAR BEET SEEDLING EMERGENCE,**  
Broom's Barn Experiment Station, Bury St. Edmunds (England). P. C. Longden.  
J Agric Sci. Vol 79, No 3, p 543-545. 1972. Illus. Identifiers: Moisture, Range, Seedling, Soils, \*Sugar beets, \*Soil conditioners, \*Clay soils.

Seven soil conditioners added to a sandy clay soil at Saxmundham (Suffolk, England) did not benefit sugar beet seedling emergence. In microplots at Broom's Barn free draining peat and sandy loam gave consistently more seedlings than limestone loam of flinty loam. In the laboratory, for each of 3 soil types, emergence was maximal only for a small soil moisture range and decreased rapidly when soils became drier or wetter. This suggests that conditioners which increase water-holding capacity should be tested on sandy loams rather than clay soils and that seed bed preparation on heavier soils should seek to aerate the soil. Copyright 1973, Biological Abstracts, Inc.  
W74-00389

**DRAIN INSTALLATION FOR NITRATE REDUCTION,**  
Southwestern Irrigation Field Station, Brawley. For primary bibliographic entry see Field 05G.  
W74-00398

**SOIL CONDITIONS UNDER FEEDLOTS AND ON LAND TREATED WITH LARGE AMOUNTS OF ANIMAL WASTES,**  
Southwestern Great Plains Research Center, Bushland, Tex.  
For primary bibliographic entry see Field 05B.  
W74-00399

**HUMAN AND ANIMAL WASTES AS FERTILIZERS,**  
Metropolitan Sanitary District of Greater Chicago, Ill.  
For primary bibliographic entry see Field 05D.  
W74-00419

**SPRINKLING CATTLE FOR RELIEF FROM HEAT STRESS,**  
Agricultural Research Service, Davis, Calif. Agricultural Engineering Research Div. S. R. Morrison, R. L. Givens, and G. P. Lofgreen. Paper No. 72-423 presented at the 1972 Annual Meeting, American Society of Agricultural Engineers, Hot Springs, Arkansas, June 27-30, 1972. 12 p, 1 fig, 5 tab.

Descriptors: \*Cattle, \*Sprinkling, Feed lots, Air conditioning, Temperature, Performance, \*California.  
Identifiers: \*Heat stress, Respiratory rate.

Sprinkling cattle under shade during the summer in the Imperial Valley of California for one minute every 30 minutes when the temperature was above 80°F resulted in significantly higher feed consumption and rate of gain, compared with cattle under shade and not sprinkled. Efficiency of feed conversion, although favoring the sprinkling operation, was not significantly improved over that of uncooled cattle. Sprinkling was as effective as a refrigerated air conditioned barn at 75°F in one trial and more effective during a second trial. Sprinkling and refrigeration promoted greater comfort as indicated by the prevention of increases in respiratory rate and body temperature observed in the afternoon with control cattle. Both noncooled and cooled cattle consumed more feed and gained

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

### Control of Water on the Surface—Group 4A

more weight with 40 feet per head of space than with 20 feet. (East-Central)  
W74-00421

**MANURING OF POTATOES ON FEN SILT SOILS IN HOLLAND, LINCOLNSHIRE,**  
Agricultural Development and Advisory Service,  
Cambridge (England).  
C. Berryman, T. Batey, T. H. Caldwell, and D. A.  
Boyd.  
Journal of Agricultural Science, Vol 80, p 269-281,  
April, 1973. 1 fig, 12 tab, 17 ref.

Descriptors: Silts, \*Fertilizers, \*Potatoes,  
Nitrogen, Phosphorus, Potassium, \*England,  
\*Nutrients, Drainage, \*Farm wastes, \*Waste  
disposal, Soil profiles.

Identifiers: Tuber blackening.

Eighteen potato manurial experiments were conducted on silt soils in England between 1953 and 1963. The mean response to nitrogen in these soils was much larger than in most English soils, but responses were varied from site to site. The nitrogen was effective in increasing tuber size and yield of ware; phosphorus increased tuber numbers and decreased ware percentage. Because of the heavy potassium content of the soils tested, responses to the potassium were slight. Cooking tests showed little effect of manurial treatment on the amount or degree of tuber blackening. The recommended fertilizer nutrient requirements for light and medium silt soils are N—200 kg/ha, P2O5—130 kg/ha, and K2O—190 kg/ha. The same nutrient recommendations for the heavy silt soils were 200 kg/ha, 310 kg/ha, and 100 kg/ha respectively. (Frantz-East Central)  
W74-00422

**AGRICULTURE AND ENVIRONMENT,**  
For primary bibliographic entry see Field 05B.  
W74-00427

**THE TRANSPERSION OF CORN,**  
Baghdad Univ. (Iraq). Coll. of Agriculture.  
For primary bibliographic entry see Field 02D.  
W74-00467

**WATER REQUIREMENTS OF WHEAT (TRITICUM AESTIVUM L.) FROM METEOROLOGICAL PARAMETERS,**  
Meteorological Service of Canada, Toronto (Ontario).

B. Padmanabhamurty, and S. K. Dasgupta.  
Indian J Agric Sci, Vol 42, No 3, p 223-226. 1972.  
Illus.

Identifiers: Air temperature, Equations,  
\*Evapotranspiration, Meteorological parameters,  
Relative humidity, Sunshine, Temperature, Transpiration,  
Triticum-Aestivum, \*Wheat, Wind speed, \*Water requirements.

Evapotranspiration from wheat crop was estimated from air temperature, wind speed, sunshine duration and relative humidity. An equation was developed for the climatic conditions obtained at Poona, India. The equation was derived from 1962-63 data and was tested by applying it to the observed data for 1954-55 and 1957-58 from a wheat crop. Within the limits of accuracy of observation, the estimated values are closely related to observed values.—Copyright 1973, Biological Abstracts, Inc.  
W74-00468

**EFFECT OF IRRIGATION AND FERTILIZER LEVELS ON THE YIELD AND QUALITY OF GROUNDNUT,**  
Haryana Agricultural Univ., Hissar (India).  
B. P. Singh, Kanwar Singh, and T. P. Yadava.  
Haryana Agric Univ J Res, Vol 1, No 2, p 11-14.  
1971.

Identifiers: \*Fertilizers, \*Groundnut, \*Irrigation, Crop yield.

W74-00490

During the first year I2 treatment (1 irrigation at flowering + 1 irrigation at pod formation) gave significantly higher pod yield than control and I1 treatment (irrigated at flowering stage). On an average, the increase due to 2 irrigations (I2) was 417 kg/ha over the control and 381 kg/ha pods over that obtained with I1. The application of 15, 30 and 60 kg P2O5/ha gave 93, 154 and 169 kg increase in pod yield/ha. The shelling percentage and oil content were not affected significantly by any of the treatments.—Copyright 1973, Biological Abstracts, Inc.  
W74-00469

**EFFECT OF SOIL DROUGHT ON WATER AVAILABILITY AND PLANT GROWTH, (IN RUSSIAN),**  
Moscow State Univ. (USSR).

N. A. Muromtsev.  
Vestn Mosk Univ Ser 6 Biol Pochvoved. Vol 27, No 2, p 83-88. 1972. Illus. (English summary).  
Identifiers: Drought, Growth (Plants), \*Soil drought, Water availability, Crop yield, \*Oats, Soil moisture.

As a result of periodic soil droughts, oat harvest considerably decreased, but drought resistance of the plants increased. The soil moisture wilting % for oats which had not been exposed to droughts, was 1.5-2.0% higher than that for plants, which had been exposed to droughts.—Copyright 1972, Biological Abstracts, Inc.  
W74-00475

**THE INFLUENCE OF MANURE AMELIORATION TREATMENTS ON PHYSICAL PROPERTIES OF SANDY SOIL, (IN POLISH),**  
Instytut Uprawnego Nowozienia i Gleboznawstwa, Baborow (Poland).

R. Baranowski, and W. Ploszynska.  
Pamiet Pulawski. 45. p 73-84. 1971. Illus. (English summary).  
Identifiers: Amelioration, \*Manure treatment, Physical properties, Porosity, \*Sandy soil, Crop yield, \*Soil treatment.

In order to investigate the efficiency of Egerseg's method an experiment on sandy soil was established by varying the plowing depth and the quantity of manure applied to the soil. After 5 yr the treatments were repeated. After 10 yr measurements of physical properties characterizing the compression and air-water-relationships in respective layers of the soil profile were performed. The amelioration increased the field capacity of soil but did not change the permanent wilting point and maximal hygroscopicity of the soil. The increase of water storage was from 10 to 25%. Plots with 2 manure applications showed a better pore distribution as a result of an increase of quantity of medium pores providing plants with water. Deep plowing and addition of organic matter changed the natural structure of the soil profile. The total porosity of the plowing layer decreased but the subsoil layer became looser. Yield increases were related to improved soil physical properties.—Copyright 1973, Biological Abstracts, Inc.  
W74-00484

**INCREASING THE EFFECTIVENESS OF IRRIGATED AGRICULTURE IN THE CHUY VALLEY OF KIRGHIZIA, (IN RUSSIAN),**  
D. S. Lailev, and V. K. Gorbunova.  
Izv Akad Nauk Kirg SSR. 5 p 69-75. 1971.

Identifiers: Agriculture, \*Irrigation, \*USSR (Kirghizia), Farms.

Considerable variations in the effectiveness of production were observed in different zones and farms with irrigated lands.—Copyright 1973, Biological Abstracts, Inc.

**YIELD AND CHEMICAL COMPOSITION OF COCKSFOOT IN DEPENDENCE OF NITROGEN FERTILIZATION AND WATER SUPPLY, (IN RESEARCH),**  
Instytut Uprawnego Nowozienia i Gleboznawstwa, Baborow (Poland).  
E. Stuczynska, J. Stuczynska, S. Jakubowski, and B. Jasinska.  
Pamiet Pulawski. 44. p 119-144. 1971. Illus. (English summary).

Identifiers: Calcium, Chemical composition, \*Cocksfoot, Fertilization, Irrigation, Magnesium, Minerals, \*Nitrogen fertilizer, Phosphorus, Potassium, Sodium, Uptake, \*Water supply, Crop yield.

N was applied in rates divided between 4 successive cuts. In one subblock plants were provided with water by rainfall only, while in the other rainfall deficiency was supplemented by tap water. A positive influence of irrigation on the yield increase of fodder cocksfoot and fertilized with N, but not with too high doses (720 kg N/ha) was found. The N fertilization decreased water utilization for the production of the dry matter unit. N fertilization caused some changes in chemical composition namely the increase of the content of total N, protein N and non-protein forms of N, especially of nitrate N, usually the increase of Ca, Mg, and Na content and the decrease of P and K content. Irrigation had no great influence on the P, K, Ca and Mg content but it increased Na and in general the decreased N content. Due to N fertilization the uptake of mineral components was greater and irrigation stimulated this uptake. The higher N doses decreased the sum of carbohydrates, while they did not change the content of raw fiber.—Copyright 1973, Biological Abstracts, Inc.  
W74-00491

## 04. WATER QUANTITY MANAGEMENT AND CONTROL

### 4A. Control of Water on the Surface

**CHEMICAL AND BIOLOGICAL CHARACTER OF RIO GRANDE WATER IN THE BOSQUE DEL APACHE WILDLIFE REFUGE,**  
New Mexico Inst. of Mining and Technology, Socorro, Dept. of Chemistry.

D. K. Brandvold, J. A. Brierley, and C. J. Popp.  
Available from the National Technical Information Service as PB-224 450, \$3.50 in paper copy, \$1.45 in microfiche. New Mexico Water Resources Research Institute, Lu. Cruces, Technical Completion Report 030, August 1973. 50 p, 4 fig, 12 tab, 21 ref. OWRR A-038-NMEX (2).

Descriptors: \*New Mexico, \*Wildlife, \*Water quality, Eutrophication, \*Water analysis, \*Waterfowl, Microbiology, Aquatic microbiology, Salinity, Sediments, Biological properties, Chemical analysis, Nitrogen, Mercury (Metal), Biochemical oxygen demand, Water temperature, Dissolved oxygen, Dissolved solids, Silica, Sulfates, Nitrates, Chemical oxygen demand, Bacteria, Aquatic microorganisms, \*Rio Grande River, Hydrogen ion concentration.  
Identifiers: Specific conductance, Dissolved phosphates, Chloride, Fecal coliform, Uric acid.

The project purpose was to study the effects of a waterfowl refuge on water quality monitoring the physical, chemical, and biological character of the water in the Bosque del Apache Wildlife Refuge along the Rio Grande in Socorro County, New Mexico. A regular monthly monitoring program over the three-year study period was set up to collect and analyze water samples from eight points

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### Group 4A—Control of Water on the Surface

within the refuge. The types of water monitored were as follows; water entering the refuge, water leaving the refuge, Rio Grande water within the refuge which served as a control since it was not used in refuge management, swamp water, irrigation water, fishing pond water, and high-water-fowl-use temporary ponds. The water used as a waterfowl habitat was not degraded in quality as a result of the presence of waterfowl. There was no increase in soluble nitrogen compounds or any other nutrient associated with eutrophication problems. There were no apparent bird-related changes in the microbiological parameters of water quality. However, impoundment of water for habitat ponds resulted in an increase of water salinity through concentration of dissolved ions by evaporation. The water used by the refuge had a high concentration of suspended sediments. This appears to effect the concentration of inorganic compounds and microbial populations by adsorption. (Creel-New Mexico)  
W74-00007

**EFFECT OF AN ERROR IN THE DETERMINATION OF THE MAXIMUM WATER EQUIVALENT OF SNOW IN A BASIN ON THE FORECAST ACCURACY OF THE SPRING FLOOD VOLUME,**  
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).  
For primary bibliographic entry see Field 02C.  
W74-00110

**EFFECT OF RIVER DISCHARGE REGULATION ON THE LOWER DON PHYTOPLANKTON, (IN RUSSIAN),**  
Azovskii Nauchno-Issledovatel'skii Institut Rybnoho Khozyaistva, Rostov-na-Donu (USSR).  
For primary bibliographic entry see Field 05C.  
W74-00120

**POLLUTION OF AIR, WATER AND SOIL BY LIVESTOCK,**  
Agricultural Research Service, Lincoln, Nebr.  
For primary bibliographic entry see Field 05G.  
W74-00135

**RESEARCH NEEDS FOR THE DESIGN AND MANAGEMENT OF BEEF FEEDLOT RUNOFF CONTROL SYSTEMS,**  
Agricultural Research Service, Lincoln, Nebr.  
For primary bibliographic entry see Field 05G.  
W74-00137

**WEED HARVEST AND LAKE NUTRIENT DYNAMICS,**  
North Dakota Univ., Grand Forks. Dept. of Biology.  
For primary bibliographic entry see Field 05C.  
W74-00150

**FLOOD CONTROL MODEL FOR MULTI-RESERVOIR SYSTEMS,**  
Natal Univ., Durban (South Africa). Dept. of Civil Engineering.  
J. S. Windsor.

Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 19 p, 4 fig, 5 ref.

Descriptors: \*Water resources development, \*Flood control, \*Reservoirs, \*Linear programming, Multiple-purpose projects, Optimization, Reservoir releases, Flood damage, Costs, Storage, Evaluation, Forecasting, Mathematical models, Systems analysis.

Identifiers: \*Cost minimization, Operating policy, Time stage, Hydro-meteorological conditions, Flood periods.

A recursive linear programming model for the analysis of a system of flood control reservoirs is presented. The system is operated over a number of discrete time periods and the model is used to determine the operating policy which minimizes the downstream damage costs associated with the magnitude of reservoir releases. By dividing flood periods into shorter operational periods, it is shown how system policies may be adjusted to incorporate the latest forecast information, and thus ensure maximum flexibility under actual operating conditions. The method proposed recognizes component interaction in time and space and affords a means of evaluating the effects of forecasting. This is accomplished with series of sequentially-related linear programming routines to cover the entire flood period, where the inputs to the model are adjusted at each time stage to reflect the changing storage and hydro-meteorological conditions. It is assumed that decisions regarding the number, location and size of the individual reservoirs have been previously made. (Bell-Cornell)  
W74-00168

**THE DEVELOPMENT OF METHODS FOR THE PLANNING OF UTILISATION AND PROTECTION OF YUGOSLAV WATER RESOURCES.**  
For primary bibliographic entry see Field 06A.  
W74-00170

**RESERVOIR OPERATION FOR RECREATION USABILITY,**  
Toronto Univ. (Ontario). Dept. of Urban and Regional Planning.  
R. Jaakson.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 99, No HY10, Proceedings Paper No 10058, p 1813-1822, October 1973. 2 fig, 6 tab, 5 ref.

Descriptors: \*Reservoir operation, \*Recreation facilities, \*Drawdown, \*Estimating, \*Water level, Water requirements, Optimization, Sequencing, Storage capacity, Systems analysis, Mathematical models, \*Canada.

Identifiers: \*Trent Canal (Ontario-Canada), Shoreline physiography.

A model for the operation of the reservoir feeder-lakes of the Trent Canal in Ontario, Canada is presented. Using data which describe shoreline physiography and a scale which ranks shoreline recreation usability, coefficients are calculated which estimate the maximum water-level drawdown that a reservoir can tolerate. Matrix conventions are used to associate drawdown tolerances to the relative and the absolute storage capacity of the reservoirs. From the matrix, priority-ordering situations for reservoir operation are identified. The sequence of operation of reservoirs can be compared in various situations of reservoir water-storage depletion, and water requirements. The model allows shoreline physical recreation usability to be included in the rationale for reservoir operation, and it quantifies means whereby the effect of reservoir operation on recreation may be minimized. (Bell-Cornell)  
W74-00185

**OPTIMIZATION OF MULTIPLE RESERVOIR SYSTEM,**  
California Univ., Los Angeles. Dept. of Engineering Systems.

W. J. Trott, and W. W-G. Yeh.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 99, No HY10, Proceedings Paper No 10065, p 1865-1884, October 1973. 5 fig, 6 tab, 17 ref.

Descriptors: \*Reservoir design, \*Dynamic programming, \*California, Hydraulics, Size, Reservoir operation, Mathematical models, Algorithms, Storage capacity, Costs, Regression analysis, Methodology, Constraints, Systems analysis.

Identifiers: \*Operating policy, \*Net benefits, Successive approximation method, Gradient technique, Coarse grid method.

The design of a system of reservoirs includes the determination of the size of the reservoir to be built at each proposed reservoir site. The design is considered optimal when the net benefits, which are a function of the reservoir sizes and the operating policy, are maximized. A method is developed to determine the optimal design of any system of reservoirs with series and parallel connections; the technique is applied to a six reservoir system. For a specific set of reservoir sizes, the return from the system is determined from the optimal operating policy. This policy is determined by decomposing the original multiple state variable dynamic programming problem by Bellman's method of successive approximation into a series of subproblems of one state variable so that the sequence of optimizations over the subproblems converge to the solution of the original problem. The costs are assumed to be a function of reservoir size and are computed from storage capacity versus cost curves. A modified gradient technique is then used to determine the set of reservoir sizes which maximize the net benefits, subject to the imposed constraints. The coarse grid method is used in which the storage increment is varied from 100,000 acre-ft. to 1,000 acre-ft. The algorithm converges to each of the given storage increments. (Bell-Cornell)  
W74-00188

**DEVELOPING A COOPERATIVE RESEARCH PROGRAM FOR FLOOD CONTROL IN BRAHMAPUTRA VALLEY,**  
Brahmaputra Flood Control Commission (India).  
For primary bibliographic entry see Field 10A.  
W74-00195

**HOW ENGINEERING RESEARCH IS REDUCED TO PRACTICE IN THE BUREAU OF RECLAMATION,**  
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.  
For primary bibliographic entry see Field 10A.  
W74-00200

**DEVELOPMENT OF MATHEMATICAL MODELING CAPABILITIES FOR THE VISTULA RIVER PROJECT, POLAND,**  
Water Resources Engineers, Inc., Walnut Creek, Calif.  
For primary bibliographic entry see Field 10A.  
W74-00218

**NEW FRONTIERS IN DRAINAGE AND RECLAMATION ENGINEERING IN THE INDUS PLAINS,**  
For primary bibliographic entry see Field 10A.  
W74-00221

**LAKE OKEECHOBEE SEEPAGE MONITORING NETWORK,**  
Geological Survey, Tallahassee, Fla.  
D. J. McKenzie.  
Open-file report 73018, 1973. 64 p, 38 fig.

Descriptors: \*Seepage, \*Dikes, \*Lakes, \*Florida, Data collections, Monitoring, Groundwater movement, Aquifer characteristics, Water level fluctuations, Hydrogeology, Seepage control, Underseepage, Water loss, Hydrologic data, Hydrographs, Water wells, Sampling, Water analysis, Chlorides, Correlation analysis, Surface-groundwater relationships.  
Identifiers: \*Lake Okeechobee (Fla).

In 1962, the Central and Southern Florida Flood Control District requested the Geological Survey to evaluate the seepage beneath the Hoover Dike

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

### Control of Water on the Surface—Group 4A

along the south shore of Lake Okeechobee. Results of the study were reported by Meyer (1971) (See W72-02954). The study indicated, among other things, a need for a monitoring program which would be helpful in determining the effects that buildup of a filtercake in lakeside borrow and changes in drainage works would have on future seepage rates. This report summarizes the data collected at the five original monitoring sites along the south shore of Lake Okeechobee from January 29, 1970 to June 28, 1972. In order to use the hydrographs in this report to full advantage, they should be studied in conjunction with Meyer's graphs and text (1971). During steady-state conditions, water seeps from the lake through the filtercake and through the aquifers beneath the dike. At those sites where the filtercake is missing, or has about the same permeability as the aquifers, the seepage from the lake is about equivalent to the flow through the aquifers. Present data are insufficient to determine whether or not filtercake buildup has reduced seepage. No appreciable change in drainage occurred during the observed period. (Woodard-USGS)

W74-00337

#### RUNOFF FORMATION ON MOUNTAIN SLOPES UNDER CARPATHIAN BEECH AND SPRUCE FORESTS, O. V. Chubaty.

Soviet Hydrology: Selected Papers, No 3, p 278-286, 1971. 8 tab, 4 ref. Translated from Forestry (Lesovedeniye), No 3, p 72-80, May-June 1971.

Descriptors: Mountain forests, \*Slopes, \*Canopy, \*Interception, \*Runoff, Infiltration, Penetration, Rainfall-runoff relationships, Runoff coefficient, Surface-groundwater relationships, Base flow, Surface runoff, Overland flow, Forest watersheds, Clear-cutting, Water year, Seasonal. Identifiers: \*USSR (Carpathian Mountains), \*Beech trees, \*Spruce trees.

Carpathian beech and spruce forest trees intercept varying amounts of atmospheric moisture. Average annual amount of precipitation intercepted by the canopy of beech and spruce is 78% and 63.6%, respectively. In winter it amounts to 85.3% for beech and 56.6% for spruce and during the growing season it is 70.7% for beech and 68.6% for spruce. Total runoff in spruce forests is approximately 2.5 times greater than that in beech forests. Most runoff occurs in beech forests in winter and spring and in spruce forests in summer. Carpathian beech and spruce have approximately the same effect on transformation of overland flow into subsurface and groundwater runoff. Differences in physiographic conditions are largely responsible for the increase in total runoff in spruce forests. The ratio of subsurface runoff to overland flow remains the same in both beech and spruce. Clear-cutting considerably reduces the water-regulating effect of the forest trees. (Josephson-USGS)

W74-00338

#### SPRING RUNOFF FROM SMALL CATCHMENTS WITH DIFFERENT FOREST COVER IN THE MOUNTAINS OF GEORGIA, L. S. Azmayparashvili, and R. G. Chagelishvili.

Soviet Hydrology: Selected Papers, No 3, p 286-289, 1971. 2 fig, 2 tab, 5 ref. Translated from Forestry (Lesovedeniye), No 3, p 81-83, May-June 1971.

Descriptors: \*Mountain forests, \*Forest watersheds, \*Small watersheds, \*Runoff, Spring, Rainfall-runoff relationships, Discharge (Water), Overland flow, Slopes, Rain water, Snowmelt, Weirs, Seasonal.

Identifiers: USSR, \*Georgian SSR.

Four catchment basins with varying degrees of forest cover were selected for study in the Boshur forested area of the Georgian Republic. The

catchments have an average elevation of 1,400-1,500 m above sea level and a gradient of 25-30 deg. Average annual amount of precipitation is 600 mm. The forest trees on slopes of the catchment basins are mainly beech-hornbeam and oak-pine stands with an admixture of spruce, fir, aspen, and birch. Runoff from catchment basins is directly proportional to precipitation intensity and inversely proportional to density of forest cover. A catchment with a cover density of 70% has no overload flow, and the range of rainfall and snowmelt runoff fluctuations is negligible. A significant increase in spring rainfall runoff and its sudden cessation in small catchments with cover densities of 30% and 50% are due to overland flow of rainwater and snowmelt water, increased evaporation from the basin surface, and unfavorable conditions of groundwater discharge into streams. Catchment basins with cover densities of 30% and 50% do not produce stable runoff. (Josephson-USGS)

W74-00339

#### INFILTRATION PROPERTIES OF SOILS AND INTRAZONAL STRUCTURE OF THE HYDROLOGIC BUDGET (INFILTRATION-NNYE SVOYSTVA POCHV I VNUTRIZONAL'-NNYE OSOBENNOSTI STRUKTURY VODNOGO BALANSA),

For primary bibliographic entry see Field 02G.  
W74-00341

#### OBSERVATIONS ON THE SOIL-WATER REGIMES IN A DRAINED CLAY SOIL,

Ministry of Agriculture, Fisheries and Food, Cambridge (England). Field Drainage Experiment Unit. For primary bibliographic entry see Field 02G.

W74-00359

#### EFFECT OF AGRICULTURAL MANAGEMENT OF WET SLOPING SOIL ON NITRATE AND PHOSPHORUS IN SURFACE AND SUBSURFACE WATER,

Agricultural Research Service, Burlington, Vt. New England Watershed Research Center. For primary bibliographic entry see Field 05B.

W74-00371

#### ESTIMATING THE PRECIPITATION CLIMATE,

Scripps Institution of Oceanography, La Jolla, Calif. For primary bibliographic entry see Field 02A.

W74-00375

#### A STREAM LENGTH STUDY,

Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 02E.

W74-00380

#### DRAIN INSTALLATION FOR NITRATE REDUCTION,

Southwestern Irrigation Field Station, Brawley. For primary bibliographic entry see Field 05G.

W74-00398

#### PERIODICITY OF THE BLUE-GREEN ALGAE AND THEIR EFFECT ON THE EFFICIENCY OF MANURE-DISPOSAL LAGOONS,

Agricultural Research Service, Washington, D.C. Agricultural Engineering Research Div.

For primary bibliographic entry see Field 05D.

W74-00430

#### CASE DESCRIPTION: MORRISON CREEK STREAM GROUP BASIN, CALIFORNIA,

For primary bibliographic entry see Field 06F.

W74-00448

#### METROPOLITAN DEVELOPMENT GUIDE, WATER RESOURCES POLICY PLAN, PROGRAM.

Metropolitan Council of the Twin Cities Area, Minn.

For primary bibliographic entry see Field 06B.  
W74-00451

#### RIVERS AND AMERICANS: A CENTURY OF CONFLICTING PRIORITIES,

For primary bibliographic entry see Field 06G.  
W74-00454

#### WATER CONTENT IN A PHYTOCOENOSIS, AND WATER BUDGET OF A ECOSYSTEM; OAK-FOREST OF VIRELLES, (IN FRENCH), Brussels Univ. (Belgium). Laboratoire de Botanique Systematique et d'Ecologie.

For primary bibliographic entry see Field 02I.  
W74-00474

#### APPLICATIONS OF LINEAR INTEGER PROGRAMMING TO PROBLEMS OF LAND USE ALLOCATION,

Michigan Univ., Ann Arbor. School of Natural Resources.

R. L. Patterson.

Available from the National Technical Information Service as COM-73-10408 \$3.00 in paper copy, \$1.45 in microfiche. SEA Grant Technical Report 31, MICHU-SG-72-213, June 1972. 36 p, 3 fig, 7 tab, 5 ref.

Descriptors: \*Land use, \*Alternative planning, \*Linear programming, Optimization, Algorithms, Decision making, \*Constraints, Costs, Equations, Mathematical models, Systems analysis, \*Michigan.

Identifiers: \*Allocation, Integer programming, Land use requirements, Resource requirements, Regulatory agencies, \*Mission Peninsula (Mich).

Constraints in the allocation of land for uses can appear in many forms, such as budget limitations for development, measures of user satisfaction, environmental quality standards, and total amount of land available. No single model is adequate to cover all combinations of possible constraints. Presented are various land use allocation problems and the method used to solve them. The problems are constrained optimization problems—choosing the most preferred pattern of site uses from a limited set of alternatives. Developers determine their own preferences covering a limited set of sites; each opts to gain his maximum advantage so that the set of land use decisions is optimized from the collective points of view of this set of users. A simplified land use assignment problem solved by integer programming and a multiple land use assignment problem utilizing linear programming are described. Difficulties in formulating linear objective functions and in specifying cell size are discussed. Then a modified site assignment problem is presented in which the simplified land use assignment model is more realistically applied redefining sites as 'feasible' for 'specific' land use 'needs'; the algorithm assigns needs to feasible sites so as to minimize total cost. Finally, a special case of 'goal programming' is described and illustrated, using linear programming. (Bell-Cornell)

W74-00503

#### NAVIGATION CONDITIONS AT CONFLUENCE OF ARKANSAS, VERDIGRIS, AND GRAND RIVERS,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.

For primary bibliographic entry see Field 08B.  
W74-00539

## Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4A—Control of Water on the Surface

**STUDIES ON THE BIOLOGY AND CONTROL OF VAUCHERIA DICHOTOMA FOUND IN FRESHWATERS IN BRITAIN,**  
Ain Shams Univ., Cairo (Egypt). Faculty of Education.  
For primary bibliographic entry see Field 02I.  
W74-00541

**WATER RESOURCES OF THE NISQUALLY INDIAN RESERVATION, WASHINGTON,**  
Geological Survey, Tacoma, Wash.  
D. A. Myers, and J. E. Cummins.  
Open-file report, 1973. 30 p, 5 fig, 12 ref, append.

Descriptors: \*Water resources, \*Water quality, \*Indian reservations, \*Washington, \*Hydrologic data, Surface waters, Groundwater resources, Water yield, Streamflow, Water wells, Aquifer characteristics, Floods, Water utilization, Water analysis, Chemical analysis, Water level fluctuations, Projections, Water resources development. Identifiers: \*Nisqually Indian Reservation (Wash).

The Nisqually Indian Reservation, Washington, has an abundant supply of good-quality surface water and groundwater for increased housing and small-scale commercial development and for potential development of a fish hatchery or other aquaculture facilities. The average annual discharge of the Nisqually River is about 2,200 cfs. Floods of the Nisqually River are reduced somewhat at La Grande and Alder Dams upstream. At the reservation, the river overflows its channel at discharges of about 21,000 cfs, which has one chance in six of happening in any one year. A floodflow of about 35,800 cfs would cover the flood plain to a depth of about 2 feet. Such a flood has one chance in 100 of happening in any one year. Yields from wells range from 5 to 25 gpm but appreciably greater yields are possible. (Woodard-USGS)  
W74-00544

**MUDY CREEK DAM AND RESERVOIR, EMERY COUNTY, FEASIBILITY STUDY.**  
Rollins, Brown and Gunnell, Inc., Provo, Utah.  
For primary bibliographic entry see Field 08A.  
W74-00546

**DRAINAGE AREAS OF TEXAS STREAMS, LAVACA RIVER BASIN.**  
Geological Survey, Austin, Tex.  
For primary bibliographic entry see Field 02E.  
W74-00548

### 4B. Groundwater Management

**MODIFICATION OF WATER QUALITY DURING ARTIFICIAL GROUNDWATER RECHARGE,**  
A. M. Perlina, and V. M. Berdanov.  
Soviet Hydrology: Selected Papers, No 4, p 391-396, 1971. 4 fig, 1 tab, 9 ref. Translated from Water Supply and Sanitary Engineering (Vodosnabzhenie i Sanitarnaya Tekhnika), No 7, p 1-4, 1971.

Descriptors: \*Groundwater recharge, \*Artificial recharge, \*Water quality control, \*Water treatment, \*Water purification, Filtration, Filters, Water properties, Water supply, Curves. Identifiers: \*USSR.

Artificial recharge of groundwater by surface water from rivers, lakes, and reservoirs is being widely practiced in a number of countries to help meet domestic water demands. In the USSR artificially recharged groundwater is being used in water-supply systems of Riga, Kaunas, Novokuznetsk, Ivano-Frankovsk and other cities. The quality of water supplied to filtration plants should meet certain requirements. The suspended-particle concentration should not exceed 10-20 mg/liter,

depending on particle size of the soil filter. Chromaticity, depending on its components, should not exceed 60 deg. The dissolved oxygen content of water, which governs permissible permanganate oxidation, should be within limits of 15 mg/liter. (Josefson-USGS)  
W74-00116

**THE DUSHANBE ARTESIAN BASIN AND ITS MINERAL AND THERMAL WATERS (DUSHANBINSKIY ARTEZIANSKIY BASSEYN I YEGO MINERAL'NYYE I TERMAL'NYYE VODY),**  
Akademiya Nauk Tadzhikskoi SSR, Dushanbe. Institut Geologii.  
N. M. Churshina.  
Izdatel'stvo 'Donish', Dushanbe, 1972. 210 p.

Descriptors: \*Groundwater basins, \*Confined water, \*Mineral water, \*Thermal water, \*Springs, Hydrogeology, Artesian aquifers, Artesian wells, Discharge (Water), Seepage, Water chemistry, Water quality, Water temperature, Inorganic compounds, Water utilization, Geologic time, Stratigraphy, Structural geology. Identifiers: \*Tadzhikistan (USSR), \*Dushanbe Artesian Basin (USSR), Paleogeography.

Aquifer complexes of highly confined, artesian mineral and thermal waters in Quaternary, Neogene, Paleogene, Upper Cretaceous, Lower Cretaceous, and Jurassic deposits of the Dushanbe Artesian Basin in the Gissar Valley of Tadzhikistan are described. Practical use of groundwater in the basin is discussed, and chemical composition, water temperature, and discharge of springs are tabulated. (Josefson-USGS)  
W74-00117

**ROLE OF DIGITAL COMPUTER MODELS OF AQUIFERS IN WATER RESOURCES PLANNING: CASE STUDY IN TUCSON, ARIZONA,**  
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.  
C. C. Kisiel, D. Supkow, and W. Tetley.  
Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 22 p, 2 fig, 7 ref.

Descriptors: Water resources, \*Planning, \*Aquifers, \*Computer models, Digital computers, \*Groundwater, Management, \*Arizona, Stochastic processes, Hydraulic models, Models studies, Evaluation, Forecasting, Water supply, Systems analysis, Economics, Risks. Identifiers: \*Tucson (Ariz), \*Error analysis, Data worth, Thermal models, Chemical models.

Aquifers have been operated with increasing frequency in conjunction with surface water systems. In some instances, as in Tucson, the aquifer serves as the only or primary source of water supply. The role of digital computer models of aquifers in planning and design and in guiding future data collection activities to reduce uncertainties in aquifer management is reviewed. An outline is presented of the elements of hydraulic, chemical and thermal models of the Tucson aquifer. The hydraulic model is a constraint on efficient allocation of water within the basin either from a supply or a demand-oriented approach. The chemical models forecast total dissolved solids and nitrate movement from reclaimed wastewater. The chemical and heat models are valuable in guiding pumping and recharge decisions. All the models can be used for analyses of the cost of forecast errors and for finding the economic worth of more data on pumping, transmissivity, storage properties, recharge and water levels in reducing uncertainty. Experience indicates that while digital computer models of aquifers are not themselves sufficient to water resources planning, they are at least one necessary element in a more rational approach to such planning. Once such models are

constructed they are easily updated and maintained as part of the planning process. (Bell-Correll)  
W74-00176

**APPLICATION OF HYDROGEOLOGICAL DATA TO LONG-TERM ECONOMICS OF GROWING SUGAR CANE IN VENEZUELA,**  
Water Development Corp., Tucson, Ariz.  
For primary bibliographic entry see Field 10A.  
W74-00196

**NITRATE CONTENT OF WELL WATER IN WEST-CENTRAL WISCONSIN,**  
Wisconsin Univ., River Falls.  
For primary bibliographic entry see Field 05B.  
W74-00246

**ARTIFICIAL-RECHARGE EXPERIMENTS AND OPERATIONS ON THE SOUTHERN HIGH PLAINS OF TEXAS AND NEW MEXICO,**  
Geological Survey, Austin, Tex.

R. F. Brown, and D. C. Signor.  
Available from NTIS, Springfield, Va. 22151 as PB-222 921; Price \$3.00 printed copy; \$1.45 microfiche. Water-Resources Investigations 10-73, May 1973. 54 p, 19 fig, 6 tab, 50 ref.

Descriptors: \*Artificial recharge, \*Groundwater recharge, \*Injection wells, \*Texas, \*New Mexico, Playas, Aquifers, Turbidity, Water quality, Water utilization, Irrigation practices, Municipal water, Industrial water, Aquifer characteristics, Evaluation. Identifiers: \*Southern High Plains (Tex and N Mex).

The Southern High Plains of Texas and New Mexico is an area where groundwater is being mined for irrigation, municipal supply, and industrial use. Artificial-recharge experiments and operations have been undertaken to develop methods to supplement the declining groundwater supplies in the Ogallala Formation, a sand and gravel aquifer of Tertiary age. Experiments using highly turbid water from playa lakes for injection into the Ogallala Formation have resulted in greatly decreased yield and limited life for the recharge wells. Recharge of groundwater and surface water of good quality have indicated, however, that injection through wells is an effective method of recharging the aquifer. Water that is slightly turbid can be injected into wells successfully for a period of time, but in most experiments, the use of turbid water resulted in constantly declining yields of the wells and constantly declining capacities for recharge. Redevelopment of wells through pumping and surging will move some of the sediment under certain conditions and significantly prolong the life of the recharge wells. Surface spreading is little practiced, but locally may be a feasible means of artificial recharge. (Woodard-USGS)  
W74-00325

**DIGITAL SIMULATION AND PROJECTION OF WATER-LEVEL DECLINES IN BASALT AQUIFERS OF THE ODESSA-LIND AREA, EAST-CENTRAL WASHINGTON,**  
Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 02F.  
W74-00326

**WATER IN THE SAN LUIS VALLEY, SOUTH-CENTRAL COLORADO,**  
Geological Survey, Denver, Colo.  
For primary bibliographic entry see Field 02A.  
W74-00331

**AVAILABILITY OF WATER FROM LIMESTONE AND DOLOMITE AQUIFERS IN SOUTHWEST OHIO AND THE RELATION OF**

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

### Groundwater Management—Group 4B

#### **WATER QUALITY TO THE REGIONAL FLOW SYSTEM,**

Geological Survey, Columbus, Ohio.

S. E. Norris, and R. E. Fidler.

Available from NTIS, Springfield, Va. 22151 as PB-222 558 Price \$3.00 printed copy; \$1.45 microfiche. Water-Resources Investigations 17-73, June 1973. 42 p, 13 fig, 1 tab, 13 ref.

**Descriptors:** \*Groundwater resources, \*Aquifer characteristics, \*Water quality, \*Ohio, Water wells, Well data, Lithologic logs, Aquifers, Water yield, Drawdown, Specific capacity, Water supply, Chemical analysis.

The largest potential water supplies from the 150- to 450-foot thick carbonate-rock aquifer in southwest Ohio are available in a 2,800 square-mile area on the crest and east flank of the Cincinnati arch. The specific capacity of 26 test wells in this high-yield area ranged from 5.4 to 106 gallons per minute per foot of drawdown and averaged 30 gpm per foot. The specific capacity of 23 test wells in the same rocks outside the high-yield area ranged from 0.5 to 5.0 gpm per foot. Wells in the high-yield area produce mainly from the Newburg zone, a permeable stratum in the lower part of the Bass Islands Group, as used by the Ohio Division of Geological Survey. A structure contour map on the top of the Lockport Dolomite shows that the Newburg zone conforms to the configuration of the Cincinnati arch. The chemical quality of the water in the consolidated-rock aquifers is intimately related to the regional flow system and undergoes a progressive change from a calcium bicarbonate type in recharge areas to a calcium sulfate type in areas of natural discharge. (Woodard-USGS)

W74-00336

#### **WATER-SALT BALANCE OF GROUNDWATER IN THE GOLODNOY STEPPE IN 1969 (VODNO-SOLEVOY BALANS PODZEMNYKH VOD GOLODNOY STEPPI ZA 1969 GOD),**

Ministerstvo Geologii, Tashkent (USSR).

M. S. Alimov, and M. M. Ingamov.

Uzbekskiy Geologicheskiy Zhurnal, No 5, p 58-61, 1971. 1 fig, 4 tab, 4 ref.

**Descriptors:** \*Groundwater, \*Water balance, \*Salt balance, \*Grasslands, Water table, Base flow, Groundwater recharge, Water storage, Inflow, Precipitation (Atmospheric), Discharge (Water), Evaporation, Runoff, Infiltration, Irrigation water, Canals.

**Identifiers:** \*USSR (Golodnaya Steppe).

The amount of water delivered to the water table in the Golodnaya Steppe in 1969 was 3,523.9 million cu m, of which 3,072.82 million cu m or 87.2% was groundwater discharge. The amount of water added to groundwater storage was 451.08 million cu m. In 1969 the Golodnaya Steppe received 6,493,000 metric tons of salt, of which 5,966,000 metric tons were removed. The total salt accumulation was 526,560 metric tons. The main sources of salt were irrigation water (4,445,400 metric tons) and atmospheric precipitation (1,600,450 metric tons). In 1969, as compared with 1960, groundwater recharge by rainfall penetration increased sharply (by 1,006.17 million cu m) as did losses from canals (by 356.29 million cu m). Infiltration from irrigated land decreased by 364.21 million cu m. Discharge of groundwater by evaporation and runoff increased by 547.74 million cu m and 458.74 million cu m, respectively. (Josefson-USGS)

W74-00340

#### **HYDROGEOLOGICAL BASIS FOR PROTECTION OF GROUNDWATER AND WATER WELLS FROM POLLUTANTS (GIDROGEOLOGICHESKOYE OBOSNOVANIYE ZASHCHITY PODZEMNYKH VOD I VODOZABOROV OT ZAGRYAZNENIY),**

For primary bibliographic entry see Field 05B.

W74-00347

#### **GEOLGY AND GROUND-WATER RESOURCES OF RUSH COUNTY, CENTRAL KANSAS,**

Geological Survey, Lawrence, Kans.

J. M. McNellis.

Kansas Geological Survey Bulletin 207, July 1973. 45 p, 18 fig, 2 plate, 13 tab, 72 ref.

**Descriptors:** \*Groundwater resources, \*Geology, \*Water wells, \*Hydrologic data, \*Kansas, Aquifer characteristics, Water yield, Water supply, Water utilization, Water quality, Groundwater movement, Groundwater recharge, Hydrogeology, Chemical analysis, Water levels.

**Identifiers:** \*Rush County (Kans.).

Rush County, which comprises an area of 724 sq. mi in central Kansas, is principally in the Smoky Hills section of the Great Plains physiographic province. The north third of the county is in the Smoky Hill River drainage basin and the rest is in the Arkansas River drainage basin. The average annual precipitation at Bison is 22.21 inches. The principal aquifers are the Dakota Formation, which underlies the entire county, and the Pleistocene deposits in the stream valleys. Yields from wells in the Dakota generally are adequate for stock and domestic purposes, but the chemical quality of the water may be considered marginal for most uses. The Pleistocene aquifer in Walnut Creek valley yields 290 to 1,200 gpm to wells for irrigation. Yields as great as 1,500 gpm have been reported. Pleistocene deposits in other stream valleys yield adequate supplies for stock and domestic purposes. Water from Pleistocene deposits commonly is hard to very hard, but is satisfactory for most uses. Recharge to the aquifer is principally from local precipitation. The aquifer in Walnut Creek valley receives sizable amounts of recharge during periods of high flow in Walnut Creek. (Woodard-USGS)

W74-00352

#### **GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1973,**

Geological Survey, Salt Lake City, Utah.

E. L. Bolke.

Utah Division of Water Resources Cooperative Investigations Report No 12, 1973. 101 p, 56 fig, 3 tab, 12 ref.

**Descriptors:** \*Groundwater resources, \*Water wells, \*Water utilization, \*Hydrologic data, \*Utah, Basic data collections, Aquifer characteristics, Water yield, Pumping, Water level fluctuations, Groundwater recharge, Precipitation (Atmospheric), Water quality, Correlation analysis, Hydrographs, Maps, Geology, Hydrogeology.

Individual discussions are presented of the most important areas of groundwater withdrawal in Utah for the calendar year 1972 and for the 10-year period 1963-72. Water-level fluctuations are described for the periods spring 1972 to spring 1973 and spring 1963 to spring 1973. The estimated total withdrawal of water from wells in Utah in 1972 was about 800,000 acre-feet, which is about 90,000 acre-feet more than for 1971 and about 200,000 more than for 1963. The increases for both the 1- and 10-year periods were due chiefly to increased withdrawal for irrigation. During 1972, precipitation was above normal in 4 of the State's 7 climatic divisions. However, precipitation was below normal for 5 of the first 6 months of 1972 for all Utah except the northern mountains. Groundwater levels were generally lower in the southwestern and central parts of Utah from February-March 1972 to February-March 1973 due to increased withdrawal for irrigation. Groundwater levels in northern Utah were variable, and no consistent pattern of water-level changes was evident. Supplementary data such as graphs showing chemical quality of water and maps showing water-table configuration are included. (Woodard-USGS)

W74-00353

#### **A RECONNAISSANCE OF THE WATER RESOURCES IN THE PAHSIMEROI RIVER BASIN, IDAHO,**

Geological Survey, Boise, Idaho.

For primary bibliographic entry see Field 02E.

W74-00356

**STEADY STATE GROUND MOTIONS CAUSED BY SINGLE-WELL PUMPING,**

Washington Univ., Seattle. Dept. of Civil Engineering.

C. B. Brown, and S. J. Burges.

Water Resources Research, Vol 9, No 5, p 1420-1427, October 1973. 5 fig, 1 tab, 10 ref.

**Descriptors:** \*Subsidence, \*Withdrawal, \*Groundwater, \*Elastic theory, Land subsidence, Groundwater movement, Drawdown, Water wells, Water yield, Equations.

Surface motions caused by well pumping often cause technical as well as legal problems. A small-deformation theory of such motions is formally developed for a single-well axially symmetric case. The theory involves no coupling between the fluid and solid phase; linear elasticity is used. Numerical comparison with field results suggests that this theory may be adequate to describe steady-state long-term ground motions. (Knapp-USGS)

W74-00361

#### **ELECTRICAL RESISTIVITY SOUNDINGS ON THE COASTAL PLAIN OF SOUTHEASTERN VIRGINIA: A FEASIBILITY STUDY,**

Old Dominion Univ., Norfolk, Va. Dept. of Geophysical Sciences.

For primary bibliographic entry see Field 02F.

W74-00437

#### **GROUND WATER RECHARGE, SOUTHERN REGIONAL DISTRICT, MONTGOMERY COUNTY, OHIO, ENGINEERING STUDY AND REPORT, PHASE I,**

Moulenbelt and Seifert, Dayton, Ohio.

Project 7204 (1973). 110 p, 46 fig, 10 tab, 26 ref.

**Descriptors:** \*Aquifers, \*Well data, \*Groundwater recharge, Groundwater, Geology, Water supply, Pit recharge, Recharge wells, Water table, \*Ohio. **Identifiers:** Great Miami River, Montgomery County (Ohio).

The study looks at the feasibility of recharging the underground aquifer which supplies the Southern Regional District Well Fields in Montgomery County, Ohio. These wells are located in a wide valley of the Great Miami River which contains glacial deposits of stones, gravel, sand, and clay from 150 to 250 feet thick. The quantity of water pumped from this aquifer has steadily increased to about 45 MGD in 1972. Since 1964, when the withdrawal was 33 MGD, the groundwater levels have dropped considerably. Thus, this study focuses on a detailed inventory of past pumping rates and groundwater levels and on exploring and evaluating possible recharge methods and systems. Natural recharge in the area is poor because of a silt layer on the ground surface. However, it is recommended that two gravel pits along the bank of the Great Miami River be used for recharge. These pits can be supplied with water from the river or receive and store storm water from local outfalls. It is recommended that 12 MGD be used for recharge to return groundwater levels to those of 1964. No new production wells should be developed except to replace existing wells until recharge program has been established. A capital investment of \$650,000 will be required for the recharge project. Operating expenses and ownership are estimated at \$80,000 a year. (Elfers-North Carolina)

W74-00439

## Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4B—Groundwater Management

#### PRELIMINARY REPORT OF PUBLIC UTILITIES ANALYSIS.

Janesville Div. of Public Works, Wis.

For primary bibliographic entry see Field 03D.

W74-00458

#### RECONNAISSANCE OF THE WATER RESOURCES OF BEAVER COUNTY, OKLAHOMA.

Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 07C.

W74-00534

#### GEOHYDROLOGY OF DONIPHAN COUNTY, NORTHEASTERN KANSAS,

Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 07C.

W74-00536

#### REGIONAL SPECIFIC YIELD OF THE EDWARDS AND ASSOCIATED LIMESTONES IN THE SAN ANTONIO, TEXAS AREA,

Geological Survey, San Antonio, Tex.

For primary bibliographic entry see Field 02F.

W74-00542

#### WATER RESOURCES OF THE NISQUALLY INDIAN RESERVATION, WASHINGTON,

Geological Survey, Tacoma, Wash.

For primary bibliographic entry see Field 04A.

W74-00544

### 4C. Effects on Water of Man's Non-Water Activities

#### EFFECTS OF WATERSHED DEVELOPMENT ON WATER QUALITY,

Tennessee Valley Authority, Chattanooga. Water Quality Branch.

For primary bibliographic entry see Field 05C.

W74-00118

#### PICLORAM MOVEMENT FROM A CHAPARRAL WATERSHED,

Forest Service (USDA), Tucson, Ariz. Rocky Mountain Forest and Range Experiment Station.

For primary bibliographic entry see Field 05B.

W74-00370

#### NUTRIENT LOSSES AFTER CLEAR-CUT LOGGING AND SLASH BURNING IN THE OREGON COAST RANGE,

Oregon State Univ., Corvallis. School of Forestry. G. W. Brown, A. R. Gahler, and R. B. Marston.

Water Resources Research, Vol 9, No 5, p 1450-1453, October 1973. 1 fig, 1 tab, 4 ref.

Descriptors: \*Nutrient removal, \*Clear-cutting, \*Runoff, Nitrates, Potassium, Phosphates, Nutrients, Sediment yield, Overland flow, Organic matter, \*Oregon, \*Small watersheds.

Nutrient release from three small watersheds in Oregon's Coast Range was monitored for 2 years before and 2 years after logging. One watershed, Flynn Creek (203.14 ha), served as an untreated control. Deer Creek (303.32 ha) was patch-cut. No change in the concentration or yield of nitrate nitrogen, phosphorus, or potassium was observed after logging. Needie Branch (70.68 ha) was clear-cut and burned. Maximum nitrate nitrogen concentrations increased from 0.70 to 2.10 mg/liter. Nitrate nitrogen concentrations returned to pre-logging levels by the sixth year after logging. Yield of nitrate nitrogen increased from 4.94 to 15.66 kg/ha the first year after treatment. Potassium concentrations increased markedly after burning from about 0.60 to 4.40 mg/liter but returned to

pre-logging levels within 2 months. Phosphorus concentrations were unchanged. These changes pose no threat to aquatic or terrestrial productivity. (Knapp-USGS)  
W74-00381

#### LAND USE AS A FACTOR IN COASTAL WATER QUALITY,

California Univ., Berkeley.

For primary bibliographic entry see Field 02L.

W74-00383

#### DEMOGRAPHIC EFFECTS OF WATER DEVELOPMENT,

For primary bibliographic entry see Field 06D.

W74-00443

#### MAN'S EFFECT ON THE GREAT LAKES,

A. M. Beeton.

In: Environmental Quality and Water Development, W. H. Freeman and Co., San Francisco. 1973. C. R. Goldman, editor p 250-280, 13 fig, 2 tab, 33 ref.

Descriptors: \*Water quality, \*Environmental effects, Coordination, \*Great Lakes, \*Eutrophication, Pollutants, Land use.

Identifiers: Intergovernmental cooperation.

Recommendations for problems generated by the impact of human, and especially urban development on the Great Lakes include: (1) establish an organization representing diverse interests and institutions to serve as a clearing house for developing a priority list of problems and for assigning projects for solution; (2) coordinate efforts of all governmental agencies; (3) disseminate information to all those concerned with Great Lakes use, conservation and management; (4) enforce all applicable water laws; (5) improve legislative basis for management; (6) establish environmental monitoring systems; (7) determine costs and benefits of improving water quality through pollution control; (8) develop water quality models for subregions; (9) examine feasibility of constructing large interception sewer systems along U.S. shores of Lakes Erie and Michigan to carry treated water into neighboring watersheds; (10) study use of dredged spoil for developing recreational lands; (11) consider development of deep water harbors; (12) emphasize the regional relationship between land use and water problems. Also discussed is accelerated eutrophication, noting a significant difference in the rate of deterioration between inshore and open lake waters. It is unrealistic to assume that the entire volume of a lake is available for dispersion and dilution of domestic, industrial and human wastes. The role of human activities in producing these changes is emphasized. (Edwards-North Carolina)  
W74-00444

#### WATER DEVELOPMENT AND URBAN RECREATION,

For primary bibliographic entry see Field 06B.

W74-00446

### 4D. Watershed Protection

#### STABILITY CRITERIA FOR BOUND-ROCK EROSION PROTECTION,

Connecticut Univ., Storrs. Inst. of Water Resources.

C. J. Posey.

Research Project Technical Completion Report, 1973. 2 p. OWRR A-035-CONN (1). OWRR 14-31-0001-3807.

Descriptors: \*Erosion control, \*Sediments, \*Watershed management, Rock fill.

Identifiers: \*Rock sausages.

Previous tests showed that the use of properly graded inverted filter layers could completely stop erosion of cohesionless soils, no matter how fine grained, and that the top layer of the filter was more resistant to being moved by strong currents if bound in mesh tubes. To find how much more resistant, three types of comparisons were made. For the first, after preliminary tests verified that the conclusion reached for cohesionless materials also applied to clay, the resistance of loose rocks and rock sausages (rock fragments encased in a tubular meshing) was compared under attack of a jet plowing through a pool. The second was based on the thrust of a high-velocity stream flowing over a level surface. The last compared fall velocities in quiet water. It was concluded that sausage diameter could safely be half that of solid rocks, but that even more could be gained by utilizing developed tension in the mesh tubes, which could be anchored.  
W74-00390

#### WATERSHED PROGRAM LACKS ECOLOGICAL DIMENSIONS,

For primary bibliographic entry see Field 06G.

W74-00442

#### SKIPACK WATERSHED AND THE EVANSBURG PROJECT: A CASE STUDY FOR WATER RESOURCES PLANNING,

For primary bibliographic entry see Field 06B.

W74-00445

#### NATURAL ENVIRONMENTAL ANALYSIS, NASHVILLE-DAVIDSON COUNTY, TENNESSEE.

Metropolitan Government of Nashville-Davidson County, Tenn. Planning Commission.

For primary bibliographic entry see Field 03D.

W74-00455

### 5. WATER QUALITY MANAGEMENT AND PROTECTION

#### 5A. Identification of Pollutants

#### CHEMICAL AND BIOLOGICAL CHARACTER OF RIO GRANDE WATER IN THE BOSQUE DEL APACHE WILDLIFE REFUGE,

New Mexico Inst. of Mining and Technology, Socorro. Dept. of Chemistry.

For primary bibliographic entry see Field 04A.

W74-00007

#### DETECTION AND MEASUREMENT.

For primary bibliographic entry see Field 05B.

W74-00010

#### ENVIRONMENTAL MONITORING TECHNIQUES.

For primary bibliographic entry see Field 05B.

W74-00013

#### GAS-CHROMATOGRAPHIC DETERMINATION OF SELENIUM,

Kentucky Dept. of Health, Frankfort. Instrumentation Lab.

For primary bibliographic entry see Field 02K.

W74-00041

#### THE RATE OF LOSS OF MERCURY FROM AQUEOUS SOLUTION WHEN STORED IN VARIOUS CONTAINERS,

Idaho Univ., Moscow. Dept. of Chemistry.

R. M. Rosain, and C. M. Wai.

Analytica Chimica Acta, Vol 65, No 2, p 279-284, July 1973. 3 fig, 1 tab, 9 ref.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Identification of Pollutants—Group 5A

**Descriptors:** \*Mercury, \*Adsorption, \*Water storage, \*Aqueous solutions, \*Plastics, Heavy metals, Hydrogen ion concentration, Acidity, Ions, Chemical analysis, Water analysis, Time, \*Pollutant identification, Methodology.

**Identifiers:** Polyvinyl chloride, Chemical loss, Glass, Natural waters, Distilled water, Flameless atomic absorption spectrophotometry, Detection limits, Sample preparation.

Solutions of natural water and distilled water were spiked with mercury (II) (25 p.p.b.) and stored in polyethylene, polyvinyl chloride, and soft glass containers. Losses of mercury at different pH values were monitored by flameless atomic absorption for a total of 17 days. Severe losses of mercury were observed at pH 2 and 7. Mercury loss from solution followed first-order kinetics; the half-lives of mercury loss under various conditions were calculated. Acidification of the solutions to pH 0.5 with nitric acid curtailed mercury loss substantially. Possible ways of reducing the loss of mercury from environmental water samples are discussed. (Holoman-Battelle)

W74-00043

#### DETERMINATION OF SOME RARE-EARTH ELEMENTS BY PLASMA-JET EMISSION SPECTROMETRY, Kitami Inst. of Tech. (Japan).

For primary bibliographic entry see Field 02K.

W74-00044

#### A NEW SET OF ACIDITY CONSTANTS FOR CARBONIC ACID AND BORIC ACID IN SEA WATER, Goteborg Univ. (Sweden). Dept. of Analytical Chemistry.

I. Hansson. Deep-Sea Research and Oceanographic Abstracts, Vol 20, No 5, p 461-478, May 1973. 3 fig, 9 tab, 34 ref.

**Descriptors:** \*Sea water, \*Chemical analysis, \*Acidity, \*Volumetric analysis, Carbonates, Methodology, Hydrogen ion concentration, Salinity, Water temperature, Chemical properties, Ions, Water analysis.

**Identifiers:** \*Carbonic acid, \*Boric acid, Potentiometric titration, Dissociation constants, Acidity constants, Inorganic acids.

The dissociation constants of carbonic acid, the acidity constant of boric acid, and the ionic product of water have been determined by potentiometric titrations in synthetic seawater. The interpolated values for the salinity range of 2-4 percent and the temperature range of 5-30°C are given for carbonic acid, boric acid, and for pK10. The activity scale is chosen so that the activity coefficient approaches unity when the concentrations of H plus, OH minus, H<sub>2</sub>CO<sub>3</sub> plus CO<sub>2</sub>, HCO<sub>3</sub> minus, CO<sub>3</sub> 2 minus, B(OH)<sub>3</sub> and B(OH)<sub>4</sub> minus approach zero in synthetic seawater of a certain salinity. The concentration unit is M sub w, moles per kg solution. Experimental methods and activity scales used by Buch, Harvey, Wattenberg and Gripenberg (1932), Buch (1938) and Lyman (1957) are reviewed. Comparisons of the concentrations of the carbonate species in a sample, obtained by use of tables given by Buch, Lyman and this work, are tabulated. (Holoman-Battelle)

W74-00046

#### CAPACITIES OF SHALLOW WATERS OF SAGAMI BAY FOR OXIDATION AND REDUCTION OF INORGANIC NITROGEN, Tokyo Univ. (Japan). Ocean Research Inst.

For primary bibliographic entry see Field 05B.

W74-00047

#### THE ENVIRONMENTAL FATE OF STRANDED CRUDE OIL, Woods Hole Oceanographic Institution, Mass.

For primary bibliographic entry see Field 05B.

W74-00049

#### SAMPLING THE EDIBLE MUSCLE OF THE SWORDFISH (XIPHIAS GLADIUS) FOR TOTAL MERCURY ANALYSIS, Fisheries Research Board of Canada, Halifax (Nova Scotia). Halifax Lab.

H. C. Freeman, and D. A. Horne.

Journal of the Fisheries Research Board of Canada, Vol 30, No 8, p 1251-1252, August 1973. 1 fig, 1 tab, 2 ref.

**Descriptors:** \*Sampling, \*Mercury, Marine fish, \*Heavy metals.

**Identifiers:** \*Swordfish, \*Muscle, Atomic absorption spectrophotometry, Biological samples, Xiphias gladius.

Samples from the longitudinal, depth, and transverse muscle sections of three swordfish were analyzed for total mercury by atomic absorption spectrophotometry. The objective was to determine whether a sample from any area would be representative of all muscle tissue. The total mercury was uniformly distributed in the edible muscle tissue of the swordfish demonstrating that a small sample from any region is representative of the whole muscle tissue. (Little-Battelle)

W74-00052

#### SEPARATION OF WATER FROM BIOLOGICAL AND ENVIRONMENTAL SAMPLES FOR TRITIUM ANALYSIS, National Environmental Research Center, Las Vegas, Nev.

A. A. Moghissi, E. W. Brethauer, and E. H. Compton.

Analytical Chemistry, Vol 45, No 8, p 1565-1566, July 1973. 1 fig, 2 tab, 3 ref.

**Descriptors:** \*Tritium, \*Separation techniques, Urine, Water, Aqueous solutions, Soil analysis, Water analysis, \*Radioactivity techniques, Distillation, Hay, Milk, Chemical analysis, Plant tissues.

**Identifiers:** Azeotropic distillation, \*Scintillation counting, Sample preparation, Tissue, Green chop, Reproducibility, Accuracy, Biological samples, Environmental samples, Animal tissues.

Azeotropic distillation of water using benzene has been tested as a means of separating water from biological and environmental samples for tritium analysis. Samples of soil, animal tissue, green chop, hay, milk, and urine were prepared using the technique, and the results of analyses compared with known or replicate values to determine accuracy and reproducibility. The results were comparable to those for samples prepared by distillation under various pressures and temperatures. However, azeotropic distillation has the advantages of short distillation time at normal pressure, does not require constant observation, and easy removal of the remaining sample for further processing. (Little-Battelle)

W74-00053

#### INORGANIC AND ORGANIC PHOSPHORUS DISTRIBUTION IN DOMESTIC AND MUNICIPAL SEWAGE, Saskatchewan Univ., Saskatoon. Dept. of Soil Science.

For primary bibliographic entry see Field 05B.

W74-00055

#### EFFECTS OF PH, LIGHT AND TEMPERATURE ON CARBARYL IN AQUEOUS MEDIA, Oregon State Univ., Corvallis. Environmental Health Sciences Center.

For primary bibliographic entry see Field 05B.

W74-00056

#### POLYCHLORINATED TERPHENYLS IN THE ENVIRONMENT, Rijksinstituut voor de Volksgezondheid, Utrecht (Netherlands). Lab. of Toxicology.

J. Freudenthal, and P. A. Greve.

Bulletin of Environmental Contamination and Toxicology, Vol 10, No 2, p 108-111, August 1973. 2 fig, 1 tab, 6 ref.

**Descriptors:** \*Water analysis, \*Oysters, \*Eels, Water pollution effects, Polychlorinated biphenyls, Absorption.

**Identifiers:** \*Polychlorinated terphenyls, \*Human fat, \*GC-mass spectrometry, \*Rhine River, Bioaccumulation, Sample preparation, Macroinvertebrates.

Water from the Rhine River, oysters, eels, and human fat were analyzed by GC-mass spectrometry for polychlorinated terphenyls (PCT). The samples were extracted in n-hexane and cleaned up by column chromatography. All recent samples contained PCT. Two of three older samples of human fat contained no PCT. Residues of PCT were somewhat lower than PCB but were of the same order of magnitude. (Little-Battelle)

W74-00057

#### A SIMPLIFIED CLEAN-UP TECHNIQUE FOR ORGANOCHLORINE RESIDUES AT THE MICROLITER LEVEL, Lund Univ. (Sweden). Dept. of Animal Ecology.

A. Södergren.

Bulletin of Environmental Contamination and Toxicology, Vol 10, No 2, p 116-119, August 1973. 1 fig, 5 ref.

**Descriptors:** \*Gas chromatography, \*Chlorinated hydrocarbon pesticides, \*Lipids, Algae, Birds, Fish, Separation techniques, DDD, DDT, Gravimetric analysis, \*Pesticide residues.

**Identifiers:** Clean up, Sample preparation, Biological samples, p,p'-DDT, p,p'-DDD, \*Organochlorine residues.

A clean-up procedure was developed, primarily for analysis of freshwater algae, in which trace amounts of chlorinated hydrocarbon pesticides and fat content can be determined by electron capture gas chromatography. Only 350 microliters of extract is required. Approximately 50 microliters of extract and an equal amount of fuming sulfuric acid are drawn into a glass tube which is then sealed by flame. The contents are mixed, centrifuged to separate phase, the tube is cut, and the acid discarded. The tube containing the hexane phase is then resealed until analysis. For confirmatory analysis, a part of the remaining original extract is cleaned up by treatment with potassium hydroxide. This is accomplished by heating a special pipette which is sealed at one end and drawing the KOH and extract into the tube as it cools. This is sealed, heated, reopened, water added, resealed, the contents mixed, and centrifuged. The hexane layer is removed and the remaining extract is analyzed for lipids by gravimetric analysis. Fatty and non-fatty samples have been cleaned-up by these procedures with residue recoveries of 78-94 percent. Treatment with KOH converts p,p'-DDT and p,p'-DDD to p,p'-DDE and p,p'-DDMU confirming the identity of the original products. The method was used to determine lipid fractions in muscle tissues of fish and birds. (Little-Battelle)

W74-00058

#### DETECTION OF TRACE AMOUNTS OF OIL IN SEA WATER BY FLUORESCENCE SPECTROSCOPY, Bedford Inst., Dartmouth (Nova Scotia).

P. D. Keizer, and D. C. Gordon, Jr.

Journal of the Fisheries Research Board of Canada, Vol 30, No 8, p 1039-1046, August 1973. 5 fig, 4 tab, 8 ref.

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification of Pollutants

Descriptors: \*Pollutant identification, \*Oil pollution, \*Monitoring, Sampling, Calibrations, Separation techniques, Storage, Evaporation, Filtration, Water analysis, \*Sea water, Oil spills, Equipment, Fluorescence.

Identifiers: Sample preparation, \*Fluorescence spectroscopy, Petroleum oil, Gas liquid chromatography, Ultraviolet spectroscopy, Fuel oil, Crude oil, On board analysis.

Because of the potential usefulness of fluorescence spectroscopy for monitoring oil in seawater, studies were conducted to develop optimum procedures and identify limitations. Calibration, extraction, storage of extracts, and evaporation procedures were examined using seawater spiked with one of three kinds of oil or with polluted natural samples. Based upon the studies, recommended procedures were developed as briefly described. Samples should be collected in a clean plastic bucket or PVC Niskin sampling bottle and transferred to a 2-l polyethylene bottle. All glassware should be cleaned and rinsed with methylene chloride. Samples should be extracted twice with methylene chloride in a separatory funnel. Extracts should be drained into a glass bottle, sealed, and stored in the dark at low temperature until analysis. At analysis, water should be removed from the sample by a separatory funnel, methylene chloride removed in a rotary evaporator at 30°C and reduced pressure, and the residue taken up with n-hexane. This solution is excited at 310 nm and the fluorescence measured at 374 nm. Comparison of the method with elemental analysis, uv spectroscopy, and GLC showed that for monitoring many samples it was sensitive and rapid. However, some limitations must be observed. Results of analysis of samples from several coastal inlets and along a section between Halifax and Bermuda show the usefulness of the method. (Little-Battelle)

W74-00059

#### GAS CHROMATOGRAPHIC PROCEDURE TO ANALYZE AMINO ACIDS IN LAKE WATERS, Wisconsin Univ., Madison. Water Chemistry Program.

W. S. Gardner, and G. F. Lee.

Environmental Science and Technology, Vol 7, No 8, p 719-724, August 1973. 4 fig, 7 tab, 10 ref.

Descriptors: \*Gas chromatography, \*Methodology, \*Chemical analysis, \*Water analysis, Lakes, \*Amino acids, Isolation, Evaluation, Cation exchange, Pollutant identification, \*Wisconsin.

Identifiers: Dissolved free amino acids, \*Sample preparation, Chemical recovery, Method evaluation, Precision, Accuracy, Ion exchange chromatography, Ligand exchange chromatography, Derivatives, Flame ionization gas chromatography, N-trifluoracetyl methyl esters, \*Lake Mendota (Wis.), Glycine, Alanine, Valine, Isoleucine, Threonine, Leucine, Serine, Proline, Tyrosine, Lysine, Phenylalanine, delta-Amino valeric acid, Error sources, Coefficient of variation.

A gas chromatographic procedure for the determination of free amino acids in lake water samples or hydrolysates has been developed. A combination of ligand exchange and ion exchange chromatography was used to isolate and concentrate the amino acids from water samples. A semimicro derivative preparation technique was developed where the N-trifluoracetyl methyl ester derivatives were formed. Recovery of the standard amino acids ranged from 53-93 percent. Poor recoveries were obtained for phenylalanine and lysine. Studies were made with fortified water samples to evaluate the precision and percent recovery of amino acids obtained with gas chromatographic procedures. The coefficients of variation generally were found to range between 5 and 20 percent for the various amino acids in the different procedures. The percent recoveries varied considerably among the respective amino acids. A

brief experiment with frozen lake water filtrates suggested that freezing lowered the recovery of dissolved free amino acids. It was concluded that gas chromatography could be used to analyze lake water for selected amino acids after appropriate purification of the samples. The relative speed of analysis offers a distinct advantage over other available procedures, but more work is needed to improve the precision and accuracy of the described procedures and to permit analysis of the remaining common protein amino acids. (Holoman-Battelle)

W74-00061

#### THE PROBABLE OCCURRENCE OF HYDROXYLAMINE IN THE WATER OF AN ETHIOPIAN LAKE, Haile Sellassi I Univ., Addis Ababa (Ethiopia).

R. M. Baxter, R. B. Wood, and M. V. Prosser. Limnology and Oceanography, Vol 18, No 3, p 470-472, May 1973. 1 tab, 14 ref.

Descriptors: \*Alkaline water, \*Water analysis, \*Pollutant identification, Lakes, Nitrites, Anions, Hydrogen ion concentration, Chemical analysis, Ammonia, Nitrates, Dissolved oxygen, Water sampling, Depth, Nitrogen compounds.

Identifiers: \*Hydroxylamine, \*Ethiopia (Lake Pawlo).

Fresh samples of water from all depths of Lake Pawlo, a moderately alkaline Ethiopian crater lake, frequently showed a marked increase in nitrite ion content after brief boiling. This did not occur, or was greatly reduced, in samples kept overnight before boiling. It is suggested that this was due to the presence of hydroxylamine. At the original pH of the water, oxidation of the hydroxylamine in the samples leads to nitrous oxide. When the sample is boiled, carbon dioxide is driven off and pH is increased. At this higher pH the oxidation of hydroxylamine follows a different pathway. Hydroxylamine may be a more frequent constituent of lake waters than has been assumed. (Holoman-Battelle)

W74-00067

#### INTERACTION OF YELLOW ORGANIC ACIDS WITH CALCIUM CARBONATE IN FRESH-WATER, Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.

For primary bibliographic entry see Field 05B. W74-00068

#### ORGANOCHLORINE INSECTICIDE RESIDUES IN STREAMS DRAINING AGRICULTURAL, URBAN-AGRICULTURAL, AND RESORT AREAS OF ONTARIO, CANADA - 1971, Department of Agriculture, London (Ontario). Research Inst.

For primary bibliographic entry see Field 05B. W74-00070

#### IDENTIFICATION OF CUTIN, A LIPID BIOPOLYMER, AS SIGNIFICANT COMPONENT OF SEWAGE SLUDGE, Washington State Univ., Pullman. Dept. of Agricultural Chemistry.

P. E. Kolattukudy, and R. E. Purdy.

Environmental Science and Technology, Vol 7, No 7, p 619-622, July 1973. 5 fig, 16 ref.

Descriptors: \*Lipids, \*Sewage sludge, \*Pollutant identification, Methodology, Solvent extractions, Chemical analysis, Domestic wastes, Organic compounds.

Identifiers: \*Cutin, \*Biopolymers, Aliphatic hydrocarbons, Thin layer chromatography, GC-Mass spectrometry, Sample preparation, Hydrogenolysis, Organic solvents, Alkanes, Mass spectra.

Sewage sludge, the end product of digestion in a domestic waste treatment plant, was thoroughly extracted with organic solvents. The residue on hydrogenolysis with LiAlH<sub>4</sub> gave polyhydroxy alkanes which accounted for 12-28 percent of the organic matter in the sludge. The major hydroxy alkanes were identified by means of chromatographic techniques in conjunction with mass spectrometry to be 1,18-dihydroxyoctadecene, 1,9,18-trihydroxy- and 1,10,18-trihydroxyoctadecane, 1,9,18-trihydroxy- and 1,10,18-trihydroxyoctadecene, 1,9,19,18-tetrahydroxyoctadecane, 1,9,10,18-tetrahydroxyoctadecene, 1,7,16-trihydroxyhexadecane, and 1,8,16-trihydroxyhexadecane. The structure and distributions of these components are unique and typical of the lipid polymer cutin. (Holoman-Battelle)

W74-00072

#### BASELINE CONCENTRATIONS OF LIGHT HYDROCARBONS IN GULF OF MEXICO, Texas A and M Univ., College Station. Dept. of Oceanography.

For primary bibliographic entry see Field 05B. W74-00073

#### WATER TEMPERATURE SURVEYS IN THE VICINITY OF POWER STATIONS WITH SPECIAL REFERENCE TO INFRA-RED TECHNIQUES, Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.

D. J. Moore, and K. W. James.

Water Research, Vol 7, No 6, p 807-820, June 1973. 6 fig, 1 append.

Descriptors: \*Water temperature, \*Surveys, \*Methodology, \*Measurement, \*Nuclear powerplants, Equipment, On-site investigations, Cooling water, Aerial photography, Powerplants, On-site tests, Water pollution effects, Surface waters, Thermometers, Depth, Infrared radiation, Isotherms, \*Thermal pollution, Water analysis, Model studies.

Identifiers: \*Infrared imagery, Thermistors, Airborne scanning, Sensors, Accuracy, Sensitivity, Infrared line scanner, Isodensitometers.

The use of three techniques for measuring water temperature is described in the context of field trials, at Berkeley Nuclear Power Station, made in 1967. Two of the techniques measure only the surface temperature of the water, the third using thermistors can record the temperature at varying depths. The techniques are complementary, but the infra-red line scan method has the great advantage of presenting a global picture of the surface temperature in a readily-digested form. Field experiments using these techniques can be most helpful in validating model studies and possible digital computer programs for examining the spread of warm water from power station cooling-water systems. (Holoman-Battelle)

W74-00076

#### GAS CHROMATOGRAPHIC DETERMINATION OF ALIPHATIC AMINES AND QUANTITATIVE ANALYSIS OF SMALL AMOUNTS OF DIMETHYLAMINE IN WASTEWATER, Uniroyal Ltd., Guelph (Ontario). Research Labs. F. I. Onuska.

Water Research, Vol 7, No 6, p 835-841, June 1973. 6 fig, 4 tab, 4 ref.

Descriptors: \*Methodology, \*Waste water (Pollution), \*Chemical analysis, \*Aqueous solutions, \*Pollutant identification, Sewage, Industrial wastes, Water analysis, Pollutants, \*Gas chromatography.

Identifiers: \*Aliphatic amines, Flame ionization gas chromatography, Quantitative analysis, Retention time, Accuracy, Sensitivity, Dialkylamines, Trialkylamines, Monoalkylamines, Flame ionization detectors, Methylamine, Ethylamine, n-

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Identification of Pollutants—Group 5A

Propylamine, n-Butylamine, Dimethylamine, Diethylamine, Di-n-butylamine, Trimethylamine, Triethylamine, n-Heptane, Di-n-propylamine, Tri-n-propylamine, Dipropylamine, Tributylamine.

A gas chromatographic procedure has been developed for the direct quantitative determination of primary, secondary and tertiary amines up to C4 in dilute aqueous solution. Industrial wastewater samples containing dialkylamines and standard dialkylamine solutions were analyzed by flame ionization gas chromatography using Pennwalt 223 amine packing for the column which is stable to water and permits the separation of the amines in industrial wastewater and sewage. The method is sensitive, specific and free from the interferences of common low volatile degradation products in sewage. Kovats' retention indices are presented for C1-C4 mono-, di-, and trialkylamines and the response factors for dialkylamines using the FID detector are given. The linearity of the FID detector was also established for dimethylamine over the concentration range of 10-4000 mg/l. (Holoman-Battelle)

W74-00077

**METHYLMERCURY AS PERCENTAGE OF TOTAL MERCURY IN FLESH AND VISCERA OF SALMON AND SEA TROUT OF VARIOUS AGES,**  
National Swedish Food Administration, Stockholm. Food Lab.  
For primary bibliographic entry see Field 05C.

W74-00079

**EXHAUSTIVE CHLORINATION AS A TECHNIQUE IN THE ANALYSIS OF AROMATIC HYDROCARBONS,**  
National Research Council of Canada, Halifax (Nova Scotia). Atlantic Regional Lab.  
O. Hutzinger, W. D. J. Jamieson, S. S. Safe, and V. Z. Zitko.  
Journal of the Association of Official Analytical Chemists, Vol 56, No 4, p 982-986, July 1973. 2 fig, 1 tab, 26 ref.

Descriptors: \*Chemical analysis, \*Methodology, Pollutant identification, Chemical reactions, Organic compounds, Chemical properties, Aromatic compounds, Polychlorinated biphenyls, \*Chlorination.

Identifiers: \*Aromatic hydrocarbons, Reagents, \*Perchlorination reactions, Polycyclic compounds, Aroclor 1254, Decachlorobiphenyl, Trichlorosulfur tetrachloroaluminate, Dibenzofuran, Halowax 1014, Naphthalene, BMC, o-Tetradechloroterpheyphenyl, Polychlorinated terphenyls, Isomers, m-Tetradechloroterpheyphenyl, p-Tetradechloroterpheyphenyl, Anthracene, Octachloroanthraquinone, Antimony pentachloride iodine, Decachlorodiphenyl ether.

Perchlorination reactions of aromatic compounds have been further investigated. The preparation and properties of decachlorodiphenyl ether and the isomeric o-, m-, and p-tetradechloroterpheyphenyls are described. Anthracene, as an example of a polycyclic aromatic hydrocarbon, gave octachloroanthraquinone when treated with the antimony pentachloride iodine reagent, but quantitative conversion to decachloroanthracene could not be obtained with reagent BMC (sulfurylchloride-aluminum chloride-sulfur monochloride). A new reagent, trichlorosulfur tetrachloroaluminate (SCl<sub>3</sub> (+)) AlCl<sub>4</sub> (-), was shown to convert Aroclor 1254 to decachlorobiphenyl. As an application of the perchlorination technique it was shown that polychlorodibenzofurans (dibenzofuran) are not present at 0.5 microgram/g in samples of Halowax 1014 and technical naphthalene, respectively. Well defined derivatives could not be obtained when phthalate esters or 'hexabromobiphenyl' (fireMaster BP-6) were treated with the BMC or SbCl<sub>5</sub>-I<sub>2</sub> reagents. (Holoman-Battelle)

W74-00080

**TASTE THRESHOLDS OF HALOGENS IN WATER,**  
Environmental Protection Agency, Boston, Mass.  
For primary bibliographic entry see Field 05F.  
W74-00119

**WATER POLLUTION,**  
Geological Survey, Washington, D.C.  
C. J. Robinove.

In: The Nation's Environment—Problems and Action, p 60-69, (1971). East Tennessee State University, Johnson City. 2 fig, 2 photo.

Descriptors: \*Pollutant identification, \*Analytical techniques, Thermal pollution, Water pollution sources, Pollutants, Water pollution control, \*Remote sensing, Analytical techniques, Environmental effects.

Water pollution is a public problem and its solution requires public understanding, public motivation, and public action. The effective solution of pollution problems requires a greater knowledge and understanding of the world. Pollution may be distinguished as either physical pollution or biological pollution based on whether the consideration is the usability of water for particular uses or the usability of the water environment. The Cuyahoga River in Ohio is used as an example of the multiplicity of pollution problems associated with water. Discussed in this context are such factors as sediment, pollutant detection, pollutant measurement, source determination, assessments of effects. A river in the Delaware estuary is used as an example of thermal pollution, the Santa Barbara oil slick is used to illustrate the application of infra red photography to pollution identification, and the Imperial Valley of California is discussed as an example of vegetation, water, and land form identification. Application of new techniques is stressed as an effective way of expanding man's understanding of his environment as a necessary precondition to water pollution control. (Wadley-Florida)

W74-00124

**WATER CHEMISTRY OF ELLICOTT CREEK, WESTERN NEW YORK,**  
Calspan Corp., Buffalo, N.Y.

M. W. Van Lier.  
Paper presented at the 16th Conference on Great Lakes Research, April 16-18, 1973; 17 p, 4 fig, 1 tab, 7 ref.

Descriptors: \*Water chemistry, Streams, Streamflow, \*New York, Water temperature, Hydrogen ion concentration, Seasonal, \*Dissolved oxygen, \*Alkalinity, \*Chlorides, \*Conductivity, \*Phosphorus.

Identifiers: Ellicott Creek (N.Y.).

Of the streams found in western New York State, the greatest contrast in quality with respect to both upstream-downstream changes and high-low flow changes, occur on Tonawanda and Ellicott Creeks. The latter body of water was the subject of an intensive six month investigation to determine changes in selected chemical variables occurring over the entire length of the stream. Temperature, dissolved oxygen, pH, alkalinity, chlorides, conductivity, and total phosphorus were measured biweekly at pre-selected stream locations. Marked seasonal changes occurred in all variables measured. Concentrations were notably affected by varying discharge rates in the stream. Pronounced diurnal variations were noted in temperature, oxygen, and pH values measured during a continuous 24 hour study. (Calspan)

W74-00166

**HOLOGRAPHIC MICROSCOPY OF DIATOMS,**  
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Physics.  
For primary bibliographic entry see Field 05C.  
W74-00247

**APPLICATION OF HIGH-SPEED LIQUID CHROMATOGRAPHY TO ORGANIC MICROANALYSIS. I. CONSTRUCTION OF A SIMPLE AND INEXPENSIVE APPARATUS,**  
City Univ. of New York.  
For primary bibliographic entry see Field 02K.  
W74-00249

**PETROCHEMICAL ANALYTICAL PROBLEMS. II. GAS-LIQUID CHROMATOGRAPHIC-MASS SPECTROMETRIC INVESTIGATION OF INDUSTRIAL DODECYLBENZENES,**  
Magyar Tudomanyos Akademia, Veszprem. Research Group for Petrochemistry.  
I. Otvos, S. Iglesias, D. H. Hunneman, B. Bartha, and A. Balthazar.

Journal of Chromatography, Vol 78, No 2, p 309-316, April 25, 1973. 2 fig, 6 tab, 18 ref.

Descriptors: \*Chemical analysis, \*Pollutant identification, Methodology, Chemicals, Organic compounds, Aromatic compounds.

Identifiers: \*GC-Mass spectrometry, \*Industrial dodecylbenzenes, \*Petrochemicals, Characterization, Chemical composition, Flame ionization gas chromatography, Molecular weight, Sensitivity, Aromatic hydrocarbons, Dodecylbenzenes, Linear, Mariikan, Dobane JN, DDB, 2-Methyl-2-phenyldecan, 2-Methyl-2-phenylundecane, 2-Methyl-2-phenyldodecane, Alkyldianes, Alkyltetralins, Undecylbenzenes, Aliphatic hydrocarbons.

The industrial dodecylbenzenes Linearil, soft and hard DDB, Mariikan, and Dobane JN were studied by gas-liquid chromatography - mass spectrometry (GLC-MS). Osmometric average molecular weights were measured with a Knauer vapor tension osmometer in benzene solution. The components of samples containing linear alkyl groups could be identified. The average molecular weights calculated from the measurements agree with independent molecular weight data. On the basis of the experimental data obtained, the following conclusions were reached: (1) The combined GLC-MS method provides reliable qualitative and quantitative analytical data for the most important characteristics of linear chain detergent alkylates, even when using a simple GLC-MS system. (2) The GLC-MS data could be controlled by independent methods and good agreement was found. (3) For branched chain products, the GLC-MS measurement yields only qualitative results of indicative character. The qualitative data may have some significance when making decisions regarding the applications of the substances, but it is more important to know the average molecular weight, which can be obtained only by other physical methods until the GC resolution can be significantly improved. (4) Alkyldianes and/or alkyltetralins could be detected in each LB sample. (5) According to the molecular weight determinations, the products investigated are undecylbenzenes on average, but according to the literature data a mean carbon number of ca. 12.5 could be expected in the alkyl chain. (6) Unequivocal evidence could be obtained that within the sensitivity limits of the measurements (ca. 0.05 percent) on the products sold as biodegradable, 'soft' products, no branched chain isomers are to be found. (Holoman-Battelle)

W74-00250

**VOLTAMMETRIC DETERMINATION OF NITRATE AND NITRITE IONS USING A ROTATING CADMIUM DISK ELECTRODE,**  
Iowa State Univ., Ames. Dept. of Chemistry.  
For primary bibliographic entry see Field 02K.  
W74-00251

**SILICA GEL AS AN INSOLUBLE CARRIER FOR THE PREPARATION OF SELECTIVE CHROMATOGRAPHIC ADSORBENTS - THE PREPARATION OF 8-HYDROXYQUINOLINE SUBSTITUTED SILICA GEL FOR THE CHELA-**

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification of Pollutants

**TION CHROMATOGRAPHY OF SOME TRACE METALS,** Rothamsted Experimental Station, Harpenden (England). Biochemistry Dept. For primary bibliographic entry see Field 02K. W74-00252

**GAS-LIQUID CHROMATOGRAPHY-MASS SPECTROMETRY OF ORGANOMERCURY COMPOUNDS,** Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab. G. L. Baughman, M. H. Carter, N. L. Wolf, and R. G. Zep. *Journal of Chromatography*, Vol 76, No 2, p 471-476, February 28, 1973. 2 fig, 2 tab, 22 ref.

Descriptors: \*Pollutant identification, Chemical analysis, Chemical degradation, Degradation (Decomposition).

Identifiers: \*Organomercury compounds, \*GC-Mass spectrometry, \*Gas liquid chromatography, Retention time, Flame ionization gas chromatography, Electron capture gas chromatography, Organomercurials, Methylmercury, Phenylmercury, Dimethylmercury, Methylmercuric iodide, Methylmercuric hydroxide, Phenylmercuric acetate, Methylmercuric bromide, Methylmercuric acetate, Methylmercuric chloride, Phenylmercuric chloride, Phenylmercuric borate, Diphenylmercury, Phenylmercuric hydroxide.

Gas-liquid chromatography-mass spectrometry (GLC-MS) was used to study GLC behavior of organomercury compounds, specifically, dimethylmercury and methylmercuric salts and phenylmercury compounds. For reference the compounds were chromatographed using flame ionization and electron capture detectors. Analyses of the methylmercury and phenylmercury compounds were performed, respectively, on 6 ft by 1/4 in glass columns containing Chromosorb W coated with 5 percent diethyleneglycol succinate and 3 percent OV-1 on Chromosorb W. The data confirmed that at low concentrations all methylmercury salts give peaks having the same retention time and that ionic methylmercury compounds undergo decomposition during GLC. The decomposing proportion appears to increase as the sample size decreases. The phenylmercury salts, even at large sample sizes, decompose to give diphenylmercury (DPM) as the major product. Reliable analyses for methylmercury salts may be achieved using GC but only if specially treated columns are used to make the decomposition reactions reproducible. Since phenylmercury salts decompose extensively, GLC is not a good method for their analysis. (Holoman-Battelle) W74-00253

**THIN-LAYER CHROMATOGRAPHY AND ENZYME INHIBITION TECHNIQUES. INTRODUCTION,** Department of National Health and Welfare, Ottawa (Ontario). Health Protection Branch. C. E. Mendoza.

*Journal of Chromatography*, Vol 78, No 1, p 29-40, April 11, 1973. 6 fig, 6 tab, 21 ref.

Descriptors: \*Chromatography, \*Pollutant identification, \*Pesticide residues, \*Analytical techniques, Pesticides, Chemical analysis, Methodology, Selectivity, Chemical reactions, Enzymes, Metabolism, Carbamate pesticides, Phosphothioate pesticides, Diazinon, Organophosphorus pesticides, Chlorinated hydrocarbon pesticides, DDT, DDD, DDE, Insecticides, Endrin, Aldrin, Dieldrin, Heptachlor.

Identifiers: \*Thin layer chromatography, \*Enzyme inhibition techniques, Biological samples, Detection limits, Sensitivity, Environmental samples, Aldicarb, Banol, Carbaryl, Carbofuran, Carbofuran 3-OH, Matacil, Metasystox-R, Mesurol, Tranid, Zectran, Baygon, Ethion, Malathion, Parathion, Alkaline phosphatase, Acid

phosphatase, Dicofol, Methoxychlor, Perthane, Benzene hexachloride, Lindane, Isodrin, Heptachlor epoxide, Chlordane, Thiometon, Isobenzan, Endosulfan, Toxaphene, Nitrophenyl phosphate, Naphthal phosphate, Methomyl, Demeton, Fenthion, Oxydemeton methyl, Dimethoate.

Thin-layer chromatography continues to be an integral part of analytical chemistry because it is versatile, sensitive, simple and rapid. The application of enzymatic methods to thin-layer chromatography is becoming more important. This chromatographic-enzymatic technique has been developed for studies of metabolic pathways of pesticides, residue analyses and forensic chemistry. The discussions deal with the development of chromatographic techniques using enzymatic reactions to detect pesticides and other biologically active compounds, principles of the technique, comparison of detection limits by various methods and enzymes, and practical applications of the technique and methods of quantitation. (Holoman-Battelle) W74-00254

**ULTRATRACE ANALYSIS (BELOW P.P.B.) BY COUPLING CENTRIPETAL THIN-LAYER CHROMATOGRAPHY AND GAS CHROMATOGRAPHY,** Ceskoslovenska Akademie Ved, Brno. Ustav Instrumentalni Analytische Chemie. J. Janak, V. Martinu, and J. Ruzickova. *Journal of Chromatography*, Vol 78, No 1, p 127-131, April 11, 1973. 2 fig, 4 ref.

Descriptors: Methodology, \*Chemical analysis, \*Pollutant identification, Chlorinated hydrocarbon pesticides, Plant tissues, Pesticide residues, Gas chromatography, Insecticides, Laboratory tests. Identifiers: \*Trace levels, \*Lindane, \*Centrifugal thin layer chromatography, \*Electron capture gas chromatography, Detection limits, Sensitivity, Biological samples.

A method for the determination of ultratrace amounts of lindane by centrifugal thin-layer chromatography combined with gas chromatography under common laboratory conditions is described. The method was used for the determination of pesticide contents in the dry material obtained from cabbage from a trial field. The accuracy of the analysis under conditions easily available in routine work is 0.1 ppb. The sensitivity limit of the method is 0.001 ppb with analytical precision. The combination of flat-bed and column techniques, suggested and represented by thin-layer centrifugal chromatography plus GC with an electron-capture detector, will be most useful for ultratrace analysis. The possibility of processing relatively large volumes of solvents containing minute amounts of compound to be analyzed, without prior purification, will permit the wider utilization of the technique in the analysis of extracts of biological materials. (Holoman-Battelle) W74-00255

**THE USE OF PRESSURE-ASSISTED LIQUID CHROMATOGRAPHY IN THE SEPARATION OF POLYNUCLEAR HYDROCARBONS,** Metropolitan Police Forensic Lab., London (England). C. G. Vaughan, B. B. Wheals, and M. J. Whitehouse.

*Journal of Chromatography*, Vol 78, No 1, p 203-210, April 11, 1973. 5 fig, 2 tab, 11 ref.

Descriptors: \*Separation techniques, \*Pollutant identification, Chemical analysis, Organic compounds, Temperature, Solvents, Methodology.

Identifiers: \*Engine oil, \*Polynuclear hydrocarbons, \*Pressure-assisted liquid chromatography, Detection limits, Reproducibility, Fluorescence detectors, Mixtures, Ultraviolet detectors, Fluorimetric detectors, Chromatographic

columns, Column preparation, Oil fingerprinting, Oil characterization.

The use of pressure-assisted liquid chromatography in the separation of polynuclear hydrocarbon mixtures in used engine oils is described. Several column packings have been investigated and columns containing Corasil/C18 have been shown to be capable of achieving useful and reproducible separations of these materials. The detection limits of the procedure using both ultraviolet and fluorescence detectors have been determined, and the effects of temperature and solvent composition on the separations were studied. (Holoman-Battelle) W74-00256

**CADMUUM CONCENTRATIONS IN SOME FISH SPECIES FROM A COASTAL AREA IN SOUTHERN NORWAY,** Norges Veterinærhøgskole, Oslo. Dept. of Biochemistry. G. N. Havre, B. Underdal, and C. Christiansen. *Oikos*, Vol 24, No 1, p 155-157, 1973. 1 tab, 7 ref.

Descriptors: Freshwater fish, Saline water fish, \*Chemical analysis, \*Cadmium, \*Pollutant identification, Methodology, Herrings, Perches, Pikes, Heavy metals, Coasts, Solvent extractions, \*Spectrophotometry.

Identifiers: \*Atomic absorption spectrophotometry, Cod (Fish), Whiting, Coalfish, Animal tissues, Fat tissue, Bioaccumulation, \*Norway, Sample preparation.

The method and results are reported for the analysis of fish for the presence of cadmium. Fish caught in a Norwegian coastal area were stored at minus 20°C until analysis by atomic absorption spectrophotometry. Sample preparation involved homogenizing, wet ashing, adjusting the pH to 3.0, buffering, and solvent extraction using a mixture of APDC (ammonium pyrrolidine dithiocarbamate) and MIBK (methyl isobutyl ketone). The cadmium concentrations were low, varying from 0.003 to 0.012 microgram/g wet weight in cod, and from 0.002 to 0.029 microgram/g, and 0.003 to 0.033 microgram/g, in whiting and herring, respectively. The results could indicate a slightly greater accumulation of cadmium in fat fish as compared to lean fish. No correlation seems to exist between the cadmium concentration and the total weight of the fish. (Holoman-Battelle) W74-00257

**COMPOSITIONAL STUDIES OF A HIGH-BOILING 370-535°C DISTILLATE FROM PRUDHOE BAY, ALASKA, CRUDE OIL,** Bureau of Mines, Bartlesville, Okla. Bartlesville Energy Research Center. H. J. Coleman, J. E. Dooley, D. E. Hirsch, and C. J. Thompson. *Analytical Chemistry*, Vol 45, No 9, p 1724-1737, August 1973. 10 fig, 7 tab, 18 ref.

Descriptors: \*Chemical analysis, Methodology, Pollutant identification, \*Distillation, Organic compounds, \*Alaska, Nuclear magnetic resonance, Aromatic compounds, Chemical degradation, Sulfur, Nitrogen, Separation techniques, Physical properties.

Identifiers: Chemical composition, \*Crude oil, \*Petroleum distillates, Boiling point, \*Prudhoe Bay (Alas.), \*Oil characterization, Aromatic hydrocarbons, Gel permeation chromatography, Silica gel adsorption chromatography, Alumina gel adsorption chromatography, NMR spectra, Sample preparation, Petroleum residues, Light gasoline, Naphtha, Gas oil, Kerosene, Paraffins, Naphthenes.

In addition to providing some of the general characteristics of the Prudhoe Bay, Alaska, crude oil as determined by the Bureau of Mines routine method of analysis, this paper presents a com-

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prehensive analytical characterization of a high-boiling 370y535C distillate. Following distillate preparation by several distillation steps in special distillation equipment, careful separating procedures with ion-exchange resins, coordination-complex formation of neutral nitrogen compounds with ferric chloride, and dual silica-alumina gel adsorption provided suitable concentrate fractions for further study. Subdivision of aromatics into three major aromatic types-monoaromatics, diaromatics, and polycyclic-aromatics-polarly simplified subsequent separation and characterization studies. Monoaromatic, diaromatic, and polycyclic-aromatics-polarly combined represent a large portion (45.5 percent) of the 370-535C boiling range distillate of the Prudhoe Bay, Alaska, crude oil, the importance of which justified detailed determinations of the number of rings involved, the relative aromaticity, and the degree of condensation of aromatic, naphthalene, or heterocyclic rings. Further analytical separations by GPC, followed by determination of mass and NMR spectral data on the resulting GPC subfractions, provided a basis for determining a much more intelligible and reasonable understanding of compound type distributions for this specific high-boiling 370-535C Prudhoe Bay, Alaska, crude oil distillate. The end result is a scheme of sample preparation, analysis, and characterization that should be applicable to similar high-boiling distillates from other crude oils and of value to the petroleum industry in studies related to the origin of petroleum as well as its production, processing, storage, and usability. (Holoman-Battelle)

W74-00258

#### ADSORPTION OF TRACES OF INSECTICIDES FROM WATER ON POLYETHYLENE, (ADSORPTION VON SPUREN VON INSECTICIDEN AUS WASSER AN POLYATHYLEN),

Mainz Univ. (West Germany).

K. Beyermann, and W. Eckrich.

Zeitschrift fur Analytische Chemie, Vol 265, No 1, p 1-4, May 25, 1973. 5 fig, 1 tab, 2 ref.

Descriptors: \*Adsorption, Water, \*Separation techniques, \*Insecticides, \*Pesticides, Plastics, DDT, Aqueous solutions, Methodology.

Identifiers: \*Pollutant removal, \*Trace levels, Lindane.

Traces of pesticides, like lindane or DDT, are adsorbed from an aqueous phase to polyethylene. The different variables that influence the adsorption process are demonstrated. However, the procedure cannot be used for analytical purposes, as materials suspended in most of the water samples adsorb insecticides themselves. (Holoman-Battelle)

W74-00259

#### A SYSTEM FOR POLYACRYLAMIDE GEL ELECTROPHORESIS OF HUMIC ACIDS, (EIN SYSTEM ZUR POLYACRYLAMIDGELEKTROPHORESE VON HUMINSÄUREN),

Medizinische Akademie Erfurt (East Germany).

Institut fuer Medizinische Mikrobiologie.

R. Klocking.

Journal of Chromatography, Vol 78, No 2, p 409-416, April 25, 1973. 5 fig, 1 tab, 9 ref.

Descriptors: \*Humic acids, Methodology, \*Separation techniques, Organic acids, Chemical analysis, \*Water analysis, Hydrogen ion concentration, \*Electrophoresis, Gels.

Identifiers: \*Peat water, Polyacrylamide gel electrophoresis, Sodium dodecyl sulfate.

A system is described for the separation of humic acid fractions of different molecular weight. Using polyacrylamide gel electrophoresis the best results were obtained with a spacer gel of pH 10.3 and a separating gel of pH 8.9. Under these experimental conditions humic acids of peat water give two sharply bounded zones in sodium dodecyl sulphate

free buffer and three bands in buffer containing 0.1 percent sodium dodecyl sulphate. (Holoman-Battelle)

W74-00260

#### A STUDY OF THE VARIATION WITH PH OF THE SOLUBILITY AND STABILITY OF SOME METAL IONS AT LOW CONCENTRATIONS IN AQUEOUS SOLUTION. PART II, IMPERIAL CHEMICAL INDUSTRIES LTD., NORTHWICH (ENGLAND). WINNINGTON LAB.

A. E. Smith.

Analyst, Vol 98, No 1164, p 209-212, March 1973.

3 tab, 6 ref.

Descriptors: \*Aqueous solutions, \*Cations, \*Metals, \*Pollutant identification, Hydrogen ion concentration, Stability, Solubility, Water storage, Methodology, Physical properties, Adsorption, Gold, Cadmium, Variability.

Identifiers: \*Atomic absorption spectrophotometry, \*Rare earth elements, \*Trace levels, Barium, Bismuth, Indium, Lithium, Palladium, Platinum, Rhodium, Ruthenium, Antimony, Tin, Thallium, Chemical concentration.

Atomic-absorption spectrophotometry was used to determine trace levels of metal ions in aqueous solution containing 0.5 percent m/v of sodium chloride in order to investigate the effect of pH upon their stability, solubility and ease of adsorption during storage. Of the thirteen metal ions investigated, namely those of gold, barium, bismuth, cadmium, indium, lithium, palladium, platinum, rhodium, ruthenium, antimony, tin and thallium, with the exception of lithium, none is stable over the pH range from 1 to 11. To ensure the stability of solutions containing these ions it is necessary to acidify them to pH 1 with hydrochloric acid immediately after sampling. (Holoman-Battelle)

W74-00261

#### THE P-VALUE APPROACH TO QUANTITATIVE LIQUID-LIQUID EXTRACTION OF PESTICIDES AND HERBICIDES FROM WATER. 3. LIQUID-LIQUID EXTRACTION OF PHENOXY ACID HERBICIDES FROM WATER, DREXEL UNIV., PHILADELPHIA, PA. DEPT. OF CHEMISTRY.

I. H. Suffett.

Journal of Agricultural and Food Chemistry, Vol 21, No 4, p 591-598, July/August 1973. 1 fig, 10 tab, 25 ref.

Descriptors: \*Solvent extractions, \*Separation techniques, \*Herbicides, \*Pollutant identification, \*Chlorinated hydrocarbon pesticides, Aqueous solutions, Methodology, Pesticide residues, Water pollution, Ethers, 2,4,5-T, 2,4-D, Adsorption, Dalapon, Gas chromatography, Water analysis, Chemical analysis, Rivers.

Identifiers: \*Liquid-liquid extraction, Chemical recovery, Isopropyl ester, n-Butyl ester, Distilled water, Natural waters, Ethyl acetate, Organic solvents, Benzene, Esters, MCPA, 2-CPA, 4-CPA, 2,4-DB, Silvex, Ultraviolet spectrophotometry, Electron capture gas chromatography.

The goal of aqueous herbicide analysis is the recovery of 100 percent of an herbicide for qualitative and quantitative analysis. Liquid-liquid extraction is the method of choice for quantitative recovery from water. The p-value concept is useful in developing an understanding of the liquid-liquid extraction process in order to select optimum experimental conditions to approach 100 percent herbicide recovery. The best solvents for extraction of phenoxy acid herbicides are ethyl acetate and ether. The best solvents for simultaneous extraction of 2,4-D or 2,4,5-T and their n-butyl and isopropyl esters are ether and ethyl acetate (2,4-D and esters) and benzene (2,4,5-T and esters). Possible variation of the p-value caused by alteration of natural water characteristics was tested. The apparent p-values for 2,4-D obtained

with waters from different sources and the p-value found in distilled water were found to be consistent. Adsorption characteristics of herbicide esters were changed upon adjustment of turbid water to the aqueous characteristics of the p-value method. Therefore the aqueous sample should be filtered before adjustment of aqueous conditions for liquid-liquid extraction. The p-value gives a theoretical guide (an F sub n value) for development of an aqueous residue procedure. Recovery data from the literature and a recovery study at high concentration confirmed the calculated F sub n value. A two-step serial extraction with 200 and 50 ml of ethyl acetate under p-value conditions is the choice for extracting 99 percent of 2,4-D from 1 l. of aqueous solution. (See also W73-10505) (Holoman-Battelle)

W74-00262

#### ON THE QUANTITATIVE DETERMINATION OF FREE CARBON DIOXIDE IN NATURAL WATERS, (ZUR QUANTITATIVEN BESTIMMUNG DER FREIEN KOHLENSAURE IN NATURLICHEN WASSERN),

For primary bibliographic entry see Field 02K.

W74-00263

#### ISOMERIZATION OF GAMMA-BHC TO ALPHA-BHC IN THE ENVIRONMENT, WISCONSIN UNIV., MADISON. DEPT. OF ENTOMOLOGY.

For primary bibliographic entry see Field 05B.

W74-00264

#### THE INFLUENCE OF AN INDUSTRIAL PLANT ON THE CHEMISTRY OF QUATERNARY WATERS IN ITS VICINITY, UPPER Odra RIVER VALLEY, (IN POLISH),

Academy of Mining and Metallurgy, Krakow (Poland). Inst. of Hydrogeology and Engineering Geology.

A. S. Kleczkowski, and J. Kowalski.

Bull Acad Pol Sci Ser Sci Terre. Vol 20, No 1, p 65-70, 1972.

Identifiers: Industrial wastes, \*Poland (Upper Odra River), Quaternary waters, Rivers, Valley, Water pollution, Air pollution, \*Chemical wastes.

From an area of 100 square km surrounding a chemical plant, more than 400 samples of water were taken in monthly series (1969-1970). In the non-isolated water-bearing horizon, marked changes in the chemical composition of water down to 15 m depth were established (SO<sub>4</sub>, Cl, Na + K, NO<sub>3</sub> mineralization). This is connected with hydrochemical characteristic zonality and extension of pollution by chimney exhalations into the atmosphere and their infiltrations (S and N). Copyright 1973, Biological Abstracts, Inc.

W74-00266

#### EXTRACTION OF DISPERSED OILS FROM WATER FOR QUANTITATIVE ANALYSIS BY INFRARED SPECTROPHOTOMETRY, NATIONAL ENVIRONMENTAL RESEARCH CENTER, EDISON, N. J. EDISON WATER QUALITY RESEARCH DIV.

M. Gruenfeld.

Environmental Science and Technology, Vol 7, No 7, p 636-639, July 1973. 4 fig, 6 ref.

Descriptors: \*Solvent extractions, \*Separation techniques, \*Oil, \*Oily water, Methodology, Water analysis, Pollutant identification, Chemical analysis, Oil spills, Sodium chloride, Pollutants, Oil pollution.

Identifiers: Trichlorotrifluoroethane, \*Infrared spectrophotometry, \*Quantitative analysis, Carbon tetrachloride, Organic solvents, Extraction efficiency, Sample preparation, Freon 113, South Louisiana crude oil, Bachaquero crude oil, No 6 fuel oil, No 2 fuel oil, Absorbance, Sulfuric acid.

An improved extraction procedure can be used to extract dispersed oils from water for quantitative

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analysis by infrared spectrophotometry. This procedure involves the addition of 50 percent H<sub>2</sub>SO<sub>4</sub> and HCl to 1-liter samples and extraction with four 25-ml portions of Freon 113 in 2-liter separatory funnels. Checks for acidity (below pH 3) and completeness of extraction should be made. A 'blank' determination is recommended for reagents and water in order to prevent interference with the oil measurement at 2930/cm by extraneous solvent extractable organics. Some of the parameters that optimize such extractions were examined. The organic solvents trichlorotrifluoroethane and carbon tetrachloride were compared in relation to extraction efficiency. Both solvents were found to be useable for the infrared determination of oil and to be about efficient in extracting dispersed oils. However, trichlorotrifluoroethane (Freon 113) is preferred since it is much less poisonous to laboratory personnel. Changes in extraction efficiency following small additions of sulfuric acid and sodium chloride were examined. Great improvement results in extraction efficiency, but no further improvement derives from addition of more salt. (Holoman-Battelle)

W74-00267

**BIODEGRADABILITY OF NONIONIC SURFACTANTS: SCREENING TEST FOR PREDICTING RATE AND ULTIMATE BIODEGRADATION,** Procter and Gamble Co., Cincinnati, Ohio. Environmental Water Quality Research Dept.

For primary bibliographic entry see Field 05B.

W74-00269

**THE DETERMINATION OF CHROMIUM IN HUMAN URINE BY GAS CHROMATOGRAPHY USING A FLAME PHOTOMETRIC DETECTOR WITH A 425, 4 NM FILTER,** Environmental Protection Agency, Perrine, Fla. Perrine Primate Lab.

R. Ross, and T. Shafik.

Journal of Chromatographic Science, Vol 11, No 1, p 46-48, January 1973. 3 fig, 2 tab, 18 ref.

Descriptors: \*Chromium, \*Urine, \*Chemical analysis, \*Pollutant identification, \*Gas chromatography, Heavy metals, Methodology, Pollutants, Monitoring, Aqueous solutions.

Identifiers: \*Flame photometric gas chromatography, Biological samples, Chemical recovery.

The determination of low levels of chromium as chromium (III) trifluoroacetyl acetonate has been previously achieved by GC using an electron capture detector. Conventional detectors, such as the electron capture detector, are sensitive but not very specific. Replacement of this detector system with a flame photometric detector equipped with a 425.4 nm filter (specific for chromium) affords both the sensitivity and specificity necessary for monitoring levels of chromium in human urine samples. The detector is linear in the range of 0 to 90 nanograms of chromium. Determination of chromium in human urine using this system has the advantages of greater specificity and linear range, as compared with other GC detector systems. The sensitivity of this system is adequate for monitoring levels of chromium in human urine. (Holoman-Battelle)

W74-00270

**COUPLING OF HIGH SPEED PLASMA CHROMATOGRAPHY WITH GAS CHROMATOGRAPHY,** National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.

For primary bibliographic entry see Field 02K.

W74-00271

**AN ON-LINE SPECTROPHOTOMETER FOR COLLECTION OF MANIPULATION OF ABSORBANCE SPECTRA,** Georgia Univ., Athens. Dept. of Biochemistry.

For primary bibliographic entry see Field 07C. W74-00272

**MICRODETECTION OF NITRATE WITH MALACHITE GREEN OR CONGO RED,** V.S. Sanatan Dharma Coll., Kanpur (India). Dept. of Chemistry.

For primary bibliographic entry see Field 02K. W74-00273

**A FLUOROMETRIC METHOD FOR THE DETERMINATION OF NITRILOTRIACETIC ACID,**

Missouri Univ., Kansas City. Dept. of Chemistry. J. L. Robinson, and P. F. Lott.

Microchemical Journal, Vol 18, No 2, p 128-136, April 1973. 2 fig, 4 tab, 12 ref.

Descriptors: \*Nitrilotriacetic acid, \*Water analysis, \*Pollutant identification, \*Methodology, \*Fluorometry, Potable water, Chemical analysis, Organic compounds, Iron, Chemical reactions, Surfactants, Water pollution, Separation techniques.

Identifiers: Chemical interference, Precision, Detection limits, Gallium, Sample preparation, Oxine.

An indirect fluorometric procedure has been described for determining trace amounts of nitrilotriacetic acid (NTA) in water. This method is based upon the reaction of NTA with the Fluorescent Ga (III)-8-hydroxyquinoline complex. In order to obtain good results, the reagents should be added in this sequence: Ga (III), oxine, buffer, NTA, and then extraction. Interference studies showed that iron greatly interferes with this analytical procedure. Tap water samples were analyzed with a relative standard deviation of 10 percent or less. This method is relatively fast and does not require expensive equipment. (Holoman-Battelle)

W74-00274

**DIRECT DETERMINATION OF BISMUTH AND ANTIMONY IN SEA WATER BY ANODIC STRIPPING VOLTAMMETRY,**

Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.

For primary bibliographic entry see Field 02K. W74-00275

**IMPROVED APPARATUS FOR DETERMINATION OF MERCURY BY FLAMELESS ATOMIC ABSORPTION,**

New England Aquarium, Boston, Mass.

T. R. Gilbert, and D. N. Hume.

Analytica Chimica Acta, Vol 65, No 2, p 461-465, July 1973. 2 fig, 1 tab, 7 ref.

Descriptors: \*Mercury, \*Laboratory equipment, Methodology, \*Aqueous solutions, Instrumentation, Chemical analysis, Heavy metals, Pollutant identification, \*Spectrophotometry.

Identifiers: \*Trace levels, \*Flameless atomic absorption spectrophotometry, Detection limits, Absorbance, Sensitivity, Sample size.

An extremely efficient purging technique is described which makes use of inexpensive equipment to measure sub-part-per-billion concentrations of mercury rapidly and over a wide range of sample sizes. The components of the apparatus are a regulated source of purge gas, flowmeter (100-1000 ml/min range), Pyrex Buchner-type funnel, and a 10-15 cm absorption cell with windows transparent at 253.7 nm. The treated sample is placed in the funnel to which is added the tin (II) reducing agent. The funnel is quickly stoppered and the purging gas and recorder are tuned on. When the pen returns to the base line, the gas flow is stopped and either a new sample added or a dilute mercury (II) chloride standard is injected in the reduced sample. The gas is again turned on and the ab-

sorbance measured. With the method described, 25 ng of mercury in a 100-ml sample with 5 ml of reductant purged at a gas flow rate of 16 ml/s in a 150-ml Buchner funnel gave a signal which reached maximum in 10 s and returned to base line in about 75 s. This peak height was 50 percent greater than the steady-state maximum (reached in about 1 min) obtained on an identical sample when the recirculation pump system and 300-ml BOD bottle sample holder supplied with a MAS 50 was used. Funnels of 30-, 60- and 150-ml capacity were used for sample sizes of 2-100 ml. Over this range several trends were observed: (1) The smaller the sample, the better the absolute sensitivity of the system. The detection limit for a 5-ml sample was 0.6 ng, but for a 50-ml sample, 2 ng. (2) The larger the sample volume the better the relative sensitivity of the technique, from a 0.12-p.p.b. detection limit for a 5-ml sample to 0.04 p.p.b. for a 100-ml samples. Practical application has been made to measuring Hg present in seawater, marine sediments, fish and other marine organisms, and clothing material. (Holoman-Battelle)

W74-00276

**STAPHYLOCOCCI AND MICROCOCCI IN SWIMMING-BATH WATER, (IN GERMAN),** L. Gruen, and H. Kleybrink.

Zentralbl Bakteriol Parasitenkd Infektionskr Hyg Erste Abt Orig Reihe B Hyg Praev Med. Vol 155, No 5, p 384-390, 1972. English summary.

Identifiers: \*Micrococci, \*Staphylococci, \*Swimming baths, Water pollution, \*E. coli.

Samples (224) of water collected from 3 swimming-baths were examined bacteriologically and chemically. With regard to the total numbers of organisms present and the Escherichia colititers, the water from these swimming-baths was regarded as satisfactory. All samples contained micrococci and 34% of them contained pathogenic staphylococci, although the content of the water in chlorine was as high as 2 mg/l of Cl<sub>2</sub>. The cause for and the significance of the presence in the bath-water of staphylococci are discussed. Copyright 1973, Biological Abstracts, Inc.

W74-00277

**INFLUENCE OF HEATING RATE ON ANALYTICAL RESPONSE IN FLAMELESS ATOMIC ABSORPTION SPECTROMETRY,** Bari Univ. (Italy). Inst. of Analytical Chemistry. G. Torsi, and G. Tessari.

Analytical Chemistry, Vol 45, No 11, p 1812-1816, September 1973. 1 fig, 12 ref.

Descriptors: \*Analytical techniques, \*Heating Rates, \*Chemical analysis, Chromium, Heavy metals, \*Spectrometers, Performance, Temperature, Instrumentation, Evaporation, Theoretical analysis, Absorption.

Identifiers: \*Flameless atomic absorption spectrophotometry, Graphite rod atomizer, Sensitivity, Detection limits.

A graphite rod flameless atomic absorption spectrometer was assembled with high chopping speed, fast response, and good noise rejection. The influence of the input power on the analytical sensitivity was investigated using chromium as a probe for rods of different geometrical dimensions. In satisfactory agreement with the theoretical model, a linear relationship was found between the peak absorption with both the input power and the thermal derivative at the evaporating surface. The possibility of obtaining kinetic information about the evaporation process is discussed. A new detection limit value, 2 picograms for chromium, is also reported. (Holoman-Battelle)

W74-00278

**MESITYL OXIDE AS AN EXTRACTING AGENT FOR BERYLLIUM,** Indian Inst. of Tech., Bombay. Dept. of Chemistry.

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For primary bibliographic entry see Field 02K.  
W74-00280

**IMPROVEMENTS IN THE MANGANESE DIOXIDE COLLECTION OF TRACE LEAD AND BISMUTH IN NICKEL,**  
International Nickel Co. of Canada Ltd., Sheridan Park (Ontario). J. Roy Gordon Research Lab.  
For primary bibliographic entry see Field 02K.  
W74-00281

**ANALYSIS OF EXPLOSIVES IN SEA WATER AND IN OCEAN FLOOR SEDIMENT AND FAUNA,**

Naval Ordnance Lab., White Oak, Md.  
J. C. Hoffsommer, D. J. Glover, and J. M. Rosen.  
Available from the National Technical Information Service as AD-757 778, \$3.00 in paper copy, \$1.45 in microfiche. Report No NOLTR-72 215, September 11, 1972. 19 p, 3 ref, append.

Descriptors: \*Sea water, \*Sediments, \*Marine animals, \*Gas chromatography, Chemical analysis, Water analysis, Marine fish, Separation techniques, Monitoring, Water pollution effects, Waste disposal, Atlantic Ocean, Pacific Ocean, Pollutant identification.

Identifiers: Rattail fish, Sea cucumber, Thin layer chromatography, Munitions, TNT, RDX, Tetryl, Ammonium perchlorate, Macroinvertebrates, Sample preparation, Biological samples.

Samples of seawater, sediment, and ocean bottom fauna (rat tail fish and sea cucumbers) were collected for analysis from two sites in the Atlantic and Pacific Oceans where surplus and obsolete munitions had been dumped. Samples were refrigerated during storage, then extracted with benzene and analyzed for TNT, RDX, and Tetryl using a combination thin layer and gas chromatography technique. Ammonium perchlorate was measured by its reaction with tetraphenylarsonium chloride which produced an insoluble perchlorate salt. No explosive contaminants were found in any of the samples analyzed. (Little-Battelle)  
W74-00285

**BIS-AROYLHYDRAZONES OF ALPHA-DIKETONES AS REAGENTS FOR COLORIMETRIC AND FLUORIMETRIC DETERMINATIONS OF CALCIUM, CADMIUM AND OTHER CATIONS,**  
Greenlane Hospital, Auckland (New Zealand). Pathology Dept.  
For primary bibliographic entry see Field 02K.  
W74-00286

**POLLUTED SNOW IN SOUTHERN NORWAY AND THE EFFECT OF THE MELTWATER ON FRESHWATER AND AQUATIC ORGANISMS,**  
Oslo Univ. (Norway). Zoological Lab.  
For primary bibliographic entry see Field 05C.  
W74-00287

**THE SOLVENT EXTRACTION OF THE TERNARY COMPLEXES OF IRON (II)-RHODAMINE B WITH VARIOUS NITROSOPHENOLS. DETERMINATION OF IRON IN WATERS,**  
Okayama Univ. (Japan). Dept. of Chemistry.  
For primary bibliographic entry see Field 02K.  
W74-00288

**MULTELEMENT INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS OF BIOLOGICAL MATERIALS,**  
Cornell Univ., Ithaca, N.Y. Dept. of Chemistry.  
For primary bibliographic entry see Field 02K.  
W74-00289

**SALTING-OUT OF ACETONE FROM WATER-BASIS OF A NEW SOLVENT EXTRACTION SYSTEM,**  
Kentucky Univ., Lexington. Dept. of Chemistry.  
For primary bibliographic entry see Field 02K.  
W74-00290

**ORGANOCHLORINE RESIDUES IN ESTUARINE MOLLUSKS, 1965-72 - NATIONAL PESTICIDE MONITORING PROGRAM,**  
Environmental Protection Agency, Gulf Breeze, Fla. Office of Pesticide Programs.  
For primary bibliographic entry see Field 05C.  
W74-00291

**DETERMINATION AND DIFFERENTIATION OF ETHYLEDIAMIINETETRA-ACETIC ACID (EDTA) AND NITRILOTRIACETIC ACID (NTA) IN FRESHWATER,**  
Department of the Environment, Burlington (Ontario). Centre for Inland Waters.  
K. L. E. Kaiser.  
Water Research, Vol 7, No 10, p 1465-1473, October 1973. 2 fig, 4 tab, 40 ref.

Descriptors: \*Nitrilotriacetic acid, \*Spectrophotometry, \*Pollutant identification, Analytical techniques, Water analysis.  
Identifiers: \*EDTA.

A fast and simple spectrophotometric method for the determination and differentiation of ethylenediaminetetra-acetic acid (EDTA) and nitrilotriacetic acid (NTA) is described. Principles, detection limits and interferences of other recent methods for the analysis of EDTA and NTA are briefly reviewed. The proposed method is based on the light absorption of cobalt (III) complexes of NTA and EDTA at 555 and 535 nm. After the determination of the sum of EDTA and NTA, the NTA complex is selectively oxidized. The absorbance then represents EDTA only. The sensitivity of the method is 10 micrograms; with preconcentration of the water sample by means of rotary evaporation a detection limit of 10 micrograms per liter is observed. (Knapp-USGS)  
W74-00295

**A SIMPLE TECHNIQUE FOR THE DIFFERENTIATION OF *ESCHERICHIA COLI* IN WATER EXAMINATION,**  
Newcastle-upon-Tyne Univ. (England). Public Health Engineering Div.  
A. P. Pugsley, L. M. Evison, and A. James.  
Water Research, Vol 7, No 10, p 1431-1437, October 1973. 1 fig, 4 tab, 14 ref.

Descriptors: \*E. Coli, \*Coliforms, \*Water analysis, \*Analytical techniques, \*Bioassay, Bioindicators, Fermentation, Pollutant identification.

New media for the demonstration of gas and indole production in a single tube were compared with other media recommended for use in the 44 deg C confirmatory test for E. coli. The use of mannitol can reduce the numbers of false positive and false negative gas reactions. Indole-production tests may be performed in the same tube as the mannitol fermentation test by including tryptone in the medium. Tryptone mannitol ricinoleate broth and tryptone mannitol broth were most suitable for the confirmation of E. coli in coliform presumptive tubes and membrane filter colonies respectively. The results of the mannitol fermentation and indole-production tests are available within 24 h at 44 deg C. The media are inexpensive and simple to prepare. (Knapp-USGS)  
W74-00296

**DETECTION OF SALTS OF 2,4-D IN AQUEOUS SOLUTION BY LASER RAMAN SPECTROSCOPY,**  
Kentucky Univ., Lexington. Dept. of Electrical Engineering.

J. M. Reeves, E. B. Bradley, and C. A. Frenzel.  
Water Research, Vol 7, No 10, p 1417-1429, October 1973. 11 fig, 3 tab, 9 ref.

Descriptors: \*2,4-D, \*Herbicides, \*Spectroscopy, \*Pollutant identification, Water analysis, Analytical techniques, Instrumentation.  
Identifiers: \*Raman spectroscopy, Lasers.

Laser Raman spectroscopy was used to detect a salt of a herbicide, 2,4-dichlorophenoxy acetic acid, in water solution at concentrations as low as 500 ppm. The Raman spectrum of the powder is substantially different from the spectrum of the pollutant in aqueous solution. The spectrum of the potassium and sodium salts are the same for the powder or aqueous solution. Five strong bands exist in aqueous solution, and four of these bands are detectable at concentrations as low as 500 ppm. All spectra were excited with a 50 mW He-Ne gas laser at 6328 Å. Lower concentrations should be detectable with a more powerful laser at a higher frequency because: (1) the intensity of the scattered radiation is proportional to the product of the intensity of the electric field perturbing the molecule and the fourth power of the scattered frequency; (2) the attenuation coefficient of water is less; (3) the photocathode used is more efficient at higher frequencies and (4) the monochromator grating used is blazed at 5000 Å. The resonance Raman effect is a possible method for the detection and identification of small optimal concentrations of pollutant in water. (Knapp-USGS)  
W74-00297

**QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1968: PART 2. SOUTH ATLANTIC SLOPE AND EASTERN GULF OF MEXICO BASINS.**

Geological Survey, Washington, D.C.  
For primary bibliographic entry see Field 02K.  
W74-00303

**SILICA-CARBONATE ALTERATION OF SERPENTINE: WALL ROCK ALTERATION IN MERCURY DEPOSITS OF THE CALIFORNIA COAST RANGES,**  
Geological Survey, Menlo Park, Calif.  
For primary bibliographic entry see Field 02K.  
W74-00304

**TOXIC MATERIALS ANALYSIS OF STREET SURFACE CONTAMINANTS,**  
URS Research Co., San Mateo, Calif.  
For primary bibliographic entry see Field 05B.  
W74-00306

**ORGANIC POLLUTANT IDENTIFICATION UTILIZING MASS SPECTROMETRY,**  
Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.  
J. M. McGuire, A. L. Alford, and M. H. Carter.  
Copy available from GPO Sup Doc as EPI-23/2-73-234, \$2.85; microfiche from NTIS as PB-224 544, \$1.45. Environmental Protection Agency, Technology Series Report EPA-R2-73-234, July 1973. 48 p, 11 fig, 5 tab, 14 ref. EPA Project 16ADN25.

Descriptors: \*Pollutant identification, \*Organic compounds, \*Mass spectrometry, \*Gas chromatography, Computers, \*Data processing, \*Organic pesticides, Phenols.  
Identifiers: Computer matching, Coal gasification effluent, Synthetic rubber effluent, Pesticide manufacturing effluent.

A system has been developed for the rapid identification of volatile organic water pollutants. It involves computer controlled gas chromatography/mass spectrometry with computerized matching of mass spectra. Application of this system to the analysis of waste effluents revealed a significant number of pollutants that were not previously known to be present. (EPA)

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification of Pollutants

W74-00309

**PREPARATIVE FREE-FLOW ELECTROPHORESIS AS A METHOD OF FRACTIONATION OF NATURAL ORGANIC MATERIALS,**  
Geological Survey, Washington, D.C.  
For primary bibliographic entry see Field 02K.  
W74-00321

**A MULTIPARAMETER OIL POLLUTION SOURCE IDENTIFICATION SYSTEM,**  
Phillips Petroleum Co., Bartlesville, Okla.  
Research and Development Dept.

J. W. Miller.

Copy available from GPO Sup Doc as EP1.23/73-221, \$1.85; microfiche from NTIS as PB-224 715, \$1.45. Environmental Protection Agency, Technology Series Report EPA-R2-73-221, July 1973. 173 p, 10 fig, 21 tab, 29 ref. EPA Project 15080 HDJ, 68-01-0059.

Descriptors: \*Oil spills, \*Chemical analysis, \*Chromatography, \*Mass spectrometry, Water pollution, Analytical techniques, Tagging, \*Pollutant identification, Statistical methods, Oil pollution.

Identifiers: Oil spill identification, Carbon isotopic composition, Sulfur isotopic composition, Statistical identification, \*Crude oil sources, n-Paraffin distribution, n-Paraffin odd-even predominance, Odd-even predominance curves, Hydrocarbon GLC profile, Sulfur GLC profile (Fingerprints).

The feasibility of oil pollution source identification is demonstrated on eighty crude oils from the world's major oil fields. Measurements of fifteen diagnostic parameters were made on the 600+F fraction of the crude oil samples. Of the fifteen parameters studied it was demonstrated that six were sufficient to distinguish among the crude oils. These parameters are carbon and sulfur isotopic composition, sulfur, nitrogen, vanadium and nickel contents. A hydrocarbon gas chromatographic profile was also diagnostic for identification but its usefulness was reduced for aged samples by the effect of weathering. The other parameters studied were the saturate, aromatic and asphaltic contents and the carbon isotopic composition of each of these fractions, the n-paraffin distribution (odd-even predominance curves) and the sulfur gas chromatographic profile. The influence of weathering on the parameters was studied. A statistical procedure based on multivariate normal analysis was developed to compare an unknown with a data library and to give an unbiased match of the unknown with a known based on the precision of the measurement methods. (EPA)

W74-00432

**BACTERIAL FLAGELLAR UNCOORDINATION AS A MONITOR FOR INDUSTRIAL POLLUTANTS,**  
Virginia Polytechnic Inst. and State Univ., Blacksburg, Dept. of Biology.

For primary bibliographic entry see Field 05B.  
W74-00438

**THE EXTRACTION OF MERCURY FROM AQUEOUS SOLUTION WITH SULFIDE-TREATED POLYURETHANE FOAM,**  
Manitoba Univ., Winnipeg, Dept. of Chemistry.  
M. A. J. Mazurski, A. Chow, and H. D. Gesser.  
Analytica Chimica Acta, Vol 65, No 1, p 99-104, June 1973. 2 fig, 2 tab, 20 ref.

Descriptors: \*Mercury, \*Separation techniques, \*Aqueous solutions, Heavy metals, Water analysis.

Identifiers: \*Polyurethane foam, \*Methylmercury, Chemical interference, Mercury chloride.

Polyurethane foam treated in an electrical discharge with hydrogen sulfide was shown to be very efficient for separating and concentrating mercury (II) chloride from aqueous solutions over the concentration range 4.0-0.0004 p.p.m. mercury. The foam removed methylmercury (II) chloride from aqueous solutions over the concentration range 2.0-0.0004 p.p.m. methylmercury, but somewhat less effectively. The results were reproducible, and the overall method appears very simple and inexpensive. This method would be very useful for concentrating very low concentrations of mercury from large volumes of water, for aqueous solutions pass easily through the foams at relatively high flow rates. These foams should make useful monitoring devices for mercury levels in industry, in environmental analysis and in the laboratory if quantitative removal of the mercury from the foams can be achieved. Results from Soxhletting the foams with 2 M hydrochloric acid, indicate that quantitative extraction and recovery of the mercury from the foams is possible. The effect of other ions competing against mercury for absorption does not appear to be important when these ions are at the levels generally found in tap water. This procedure is presently being extended to the selective extraction of other metals by the use of various complexing agents on various foams. (Little-Battelle)

W74-00459

Identifiers: \*Enzyme inhibition technique, \*Thin layer chromatography, Detection limits, Enzyme activity, Methoxychlor, p,p'-DDT, Lindane, Cholinesterase, Carboxylesterase, Enzymatic inhibitors, Esterases.

An investigation was conducted in order to evaluate the possible influence of organochlorine insecticides (active substances and formulations) on results obtained by the thin-layer chromatographic - enzyme inhibition technique and to elucidate the mechanism of such an influence. A modified method of Mendoza et al. (1969) was used with up to 30 micrograms of standards and corresponding formulations being spotted onto the plates. Enzyme (esterase) activity was measured in a dilute liver homogenate. By use of this technique, lindane in amounts of 500 ng or more is detected, whereas the other pesticides tested (p,p'-DDT, ethoxychlor, heptachlor, aldrin, dieldrin, and endrin) remain undetected up to 10 micrograms. Positive results for the tests for organophosphorus and carbamate pesticides with the thin-layer chromatographic - enzymatic technique therefore require corroboration from other tests to exclude the possibility of the presence of lindane. Kinetic enzymatic studies have shown that lindane is a non-competitive inhibitor of carboxylesterase, the predominant enzyme of liver homogenate, which is responsible for the hydrolysis of a chromogenic substrate. Lindane does not inhibit the cholinesterase in liver homogenate. (Holoman-Battelle)

W74-00461

**A COMPARISON OF A WET PRESSURE DIGESTION METHOD WITH OTHER COMMONLY USED WET AND DRY-ASHING METHODS,**  
Colorado Div. Wildlife, Fort Collins.

W. J. Adrian.  
Analyst, Vol 98, No 1164, p 213-216, March 1973. 3 tab, 3 ref.

Descriptors: Methodology, \*Chemical analysis, \*Metals, \*Phosphorus, Separation techniques, Chemical degradation, Pollutant identification, Sampling.

Identifiers: \*Sample preparation, Biological samples, \*Chemical digestion, Wet ashing, Dry ashing, Precision, Hydrogen peroxide, Sulfuric acid, Artemisia tridentata.

A wet-digestion method for the determination of metals and phosphorus in biological material that involves the use of pressure is described and comparisons are made with the standard dry and wet-ashing methods and the sulphuric acid-hydrogen peroxide method. Big sage (Artemisia tridentata) was chosen as the test material. A 500-g sample was ground to a homogeneous mixture and twenty-five 0.5-g subsamples were used for each method. The same acid stock was used for each method and all samples were predigested overnight with the exception of those being determined by the dry-ashing and sulfuric acid-hydrogen peroxide methods. The pressure method has the advantage of being able to digest many samples at the same time (to the extent that the cations sought and phosphorus can be extracted into dilute nitric acid) with very little equipment, small volumes of acid and with a low digestion temperature (that of hot tap water), with the precision of more laborious standard methods. (Holoman-Battelle)

W74-00462

**DETERMINATION OF ORTHOPHOSPHATE,**  
Arizona Univ., Tucson, Coll. of Medicine.  
R. Huxtable, and R. Bressler.  
Analytical Biochemistry, Vol 54, No 2, p 604-608, August 1973. 4 fig, 1 tab, 8 ref.

Descriptors: \*Colorimetry, \*Phosphates, Assay, \*Pollutant identification.

Identifiers: \*Sample preparation, \*Orthophosphates, Chemical interference.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Sources of Pollution—Group 5B

The Fiske and SubbaRow colorimetric procedure for phosphate determination was modified by Baginski et al. In this method, further color development at the termination of reaction by additional release of phosphate is prevented by using a complexing agent. However, the presence of ATP suppresses color development. To eliminate this problem, the following procedure was developed: 1 ml of 5 percent trichloroacetic acid is added to the sample to be analyzed. Water is added to bring the volume to 3 ml; 0.5 ml of 2.5 percent ammonium molybdate followed by 0.2 ml of 0.2 percent aminonaphthol sulfonic acid (ANSA) are next added. After a 2-min interval, 1 ml of 2 percent sodium citrate and 2 percent sodium arsenite in 2 percent acetic acid is added. The solution is mixed, and left for 15 minutes. Optical density is then read at 750 nm. One micromole of phosphate gives a color reading of 0.736 OD in a 1-cm pathlength cell. (Little-Battelle) W74-00464

**THE CHEMISTRY AND QUANTITATIVE UTILITY OF SODIUM COBALTINITRITE IN THE DETERMINATION OF PHENOLS,**  
Iowa Univ., Iowa City. Coll. of Pharmacy.  
R. V. Smith, and M. J. Garst.  
*Analytica Chimica Acta*, Vol 65, No 1, p 69-75, June 1973. 1 fig, 2 tab, 18 ref.

Descriptors: \*Aqueous solutions, \*Chemical analysis, Water analysis, Nuclear magnetic resonance, \*Phenols.  
Identifiers: \*p-Cresol, Thin layer chromatography, Atomic absorption spectrophotometry, Ultraviolet spectroscopy, Sample preparation, \*Sodium cobaltinitrite.

The reaction of p-cresol with acidified cobaltinitrite has been qualitatively and quantitatively studied. On an analytical scale, the reaction predominantly leads to 2-nitro-p-cresol. The dimer of this compound has also been identified as a minor product. Two methods have been devised for quantitative analysis. The one involves measurement at 366 nm of the 2-nitro-p-cresol formed, after extraction into chloroform. The other employs treatment with sodium hydroxide which causes conversion of 2-nitro-p-cresol to its anion which is measured at 433 nm. The first method is superior in precision and is more rapidly performed. The second provides greater sensitivity and potential selectivity. Both are useful for analyzing p-cresol and may be applicable to other p-substituted phenols. (Little-Battelle) W74-00465

**A SIMPLE PRINCIPLE FOR DOSING APPARATUS IN AQUATIC SYSTEMS,**  
Umea Univ. (Sweden). Dept. of Ecological Zoology.  
For primary bibliographic entry see Field 07B.  
W74-00473

**SUMMARY OF CHEMICAL AND RADIOCHEMICAL MONITORING OF WATER FOR THE CANNIKIN EVENT, AMCHITKA ISLAND, ALASKA, FISCAL YEAR 1972,**  
Geological Survey, Lakewood, Colo.  
For primary bibliographic entry see Field 05B.  
W74-00547

### 5B. Sources of Pollution

**CHEMICAL AND BIOLOGICAL CHARACTER OF RIO GRANDE WATER IN THE BOSQUE DEL APACHE WILDLIFE REFUGE,**  
New Mexico Inst. of Mining and Technology, Socorro, Dept. of Chemistry.  
For primary bibliographic entry see Field 04A.  
W74-00007

**NITRATE AND NITRITE VOLATILIZATION BY MICROORGANISMS IN LABORATORY EXPERIMENTS,**  
Pennsylvania State Univ., University Park. Dept. of Agronomy.  
For primary bibliographic entry see Field 05G.  
W74-00008

### TRITIUM PRODUCTION.

In: *Tritium*, p 30-85, May 1973. 25 fig, 9 tab, 66 ref. Messenger Graphics, Pub., Phoenix, Ariz., and Las Vegas, Nev., Price: \$35.00.

Descriptors: \*Tritium, \*Industrial production, \*Nuclear powerplants, Radioactivity, \*Radioactivity effects, Fallout, Effluents, Nuclear explosions, Nuclear reactors, Nuclear engineering, Safety, Air pollution, Water pollution, Water pollution sources, Soil contamination, Water vapor, Absorption, Population, Environmental effects, Food chains, Absorption, Public health.  
Identifiers: \*Nuclear detonation, \*Thermonuclear fusion, \*Fission, Plowshare.

Tritium is formed in both thermonuclear fusion and nuclear fission. Because of its intermediate half-life and biological importance, tritium poses a very special hazard to the world population. The basic mechanisms for generation of tritium in operation of nuclear reactors are reviewed. Long-term buildup of tritium and its management are discussed. Investigations are reported of prediction and measurement of tritium production in reactors. Detonation of nuclear explosives produces substantial amounts of tritium from two sources: the explosive itself and the material and rock surrounding the explosive. The tritium production by a nuclear weapon is closely related to its specific design and to the environment in which it is detonated. The effects of nuclear weapons tests on the tritium inventory can be summarized as follows: (1) The contribution from fission weapons is negligible. (2) The contribution from thermonuclear tests conducted in the atmosphere is large. The present inventory is approximately 45 times the natural background. (3) Underground testing of thermonuclear weapons has not contributed significantly to the atmospheric burden. (Houser-ORNL) W74-00009

### DETECTION AND MEASUREMENT.

In: *Tritium*, p 86-191, May 1973. 63 fig, 19 tab, 176 ref. Messenger Graphics, Pub., Phoenix, Ariz., and Las Vegas, Nev., Price \$35.00.

Descriptors: \*Tritium, \*Measurement, \*Assay, \*Monitoring, Air pollution, Water pollution, Soil contamination, Water pollution sources, Fallout, Nuclear explosions, Nuclear powerplants, Regulation, Administrative agencies, Public health.  
Identifiers: \*Thermonuclear reactors, \*Thermonuclear explosions, Fuel reprocessing, Fusion, Plowshare.

The present inventory of tritium is approximately 45 times the natural background and poses a major environmental concern. It has, therefore, established a very strong motivation among scientists to do research for establishment of methods for calibration of tritium standards, its detection and measurement. Various methods are reported for analysis, counting, measuring, and monitoring of tritium. The method of analysis/measurement used depends upon the objective and thus requires a choice of the most suitable of several techniques, using criteria such as the degree of accuracy required, response time, cost of analysis, sample quantities available, etc. Some of the methods are gas counting, enrichment and analysis of low-level tritium samples, monitoring devices, liquid scintillation systems, practical limits of determination, continuous monitoring of

aqueous tritium activity, application of emulsions in tritium counting with refrigerated systems, and new procedures for liquid scintillation counting. (Houser-ORNL) W74-00010

### KINETICS OF TRITIUM IN BIOLOGICAL SYSTEMS.

In: *Tritium*, p 289-381, May 1973. 34 fig, 24 tab, 218 ref. Messenger Graphics, Pub., Phoenix, Ariz., and Las Vegas, Nev., Price: \$35.00.

Descriptors: \*Tritium, \*Kinetics, \*Transfer, \*Biological communities, Equilibrium, \*Radioisotopes, \*Radioactivity effects, Air pollution, Water pollution, Soil contamination, Food chains, Public health, Water pollution sources, Nuclear powerplants, Distribution, Invertebrates, Bioindicators, Turnovers, Wastes, Dairy industry, Aquatic animals, Sea water, Absorption, Fish, Ecology.

Various aspects of tritium kinetics in biological systems are reported. First the kinetics and equilibrium isotope effect of tritium substitution, the chemical properties of tritium in its reactions, and a conspicuous lack of data on this isotope are reported. Other items of concern are the distribution of tritium between the hydrosphere and invertebrates, biokinetics of environmental tritium, its turnover rates in mammals and desert mammals, excretion in man under tropical conditions and via cow's milk, studies on the food chain contaminated by tritium, biological implications of tritiated luminous compounds, tritiation of aquatic animals, and the behavior of fish chronically exposed to tritium. (Houser-ORNL) W74-00011

### CERTAIN ENVIRONMENTAL ASPECTS OF TRITIUM.

In: *Tritium*, p 382-495, May 1973. 46 fig, 19 tab, 175 ref. Messenger Graphics, Pub., Phoenix, Ariz., and Las Vegas, Nev., Price: \$35.00.

Descriptors: \*Tritium, Environment, \*Atmosphere, \*Sea water, \*Soils, Air pollution, Water pollution, Soil contamination, Hazards, Water vapor, Transfer, Food chains, Public health, Radioactivity, Radioactivity effects, Radioecology, Ecosystems, Vegetation, Absorption, Behavior, Model studies, Movement, Water, Climatology.  
Identifiers: \*Tritiated water.

Tritium existed primarily in the atmosphere and surface waters in small but measurable quantities prior to nuclear bomb testing. However it is estimated to have increased approximately 50-fold as a result of atmospheric weapons testing. The radiological hazard from conversion of tritium to tritiated water in air by metal catalysts is reported. Concern is expressed for additional concentrations of tritium in the environment with additional releases from power reactors, fuel reprocessing plants, and accelerators along with the projected dosage. Some of the major pathways to man are via the food chain from exposures to tritiated water vapor, ingestion and inhalation. The Cumulative Exposure Index (CUEX) concept is being developed to facilitate realistic assessment of the effect of environmental releases of radionuclides. Its concept is explained. The effect of an exposure of the ecological system is described. The transfer of tritium, from methane gas resulting from underground detonation tests, to vegetation is reported. The movement of tritium in soil is being studied by tracer techniques. Water movement in soils under various climatological conditions is being studied through a dynamic model. (Houser-ORNL) W74-00012

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources of Pollution

#### ENVIRONMENTAL TECHNIQUES.

#### MONITORING

In: Tritium, p 496-556, May 1973. 36 fig, 12 tab, 54 ref. Messenger Graphics, Pub., Phoenix, Ariz., and Las Vegas, Nev., Price: \$35.00.

Descriptors: \*Monitoring, \*Tritium, \*Measurement, \*Assay, \*Regulation, Safety factors, Air pollution, Water pollution, Water pollution sources, Effluents, Environment, Aquatic environment, Analytical techniques, Instrumentation, Methane, Natural gas, Krypton, Radioisotopes.

Monitoring for tritium may be done for two reasons. The first is to measure releases to maintain acceptable levels, and the second serves as a check against possible mechanical failures. Various ways of monitoring for tritium are discussed. These methods are concerned with measuring tritium in water and air effluents, laboratory systems for tritium analysis of large numbers of environmental samples, and monitoring of tritium in the aquatic environment. Analytical quality control of analyses of tritium in water may be achieved through intercomparison studies. A sampler for nonaqueous tritium gases is described. Also described is a tritium stack monitor having a wide digital range. An on-line monitor for natural gas from nuclear stimulation provides a fast and accurate method for measuring tritium and krypton-85 in natural gas. (Houser-ORNL)

W74-00013

#### CAPACITIES OF SHALLOW WATERS OF SAGAMI BAY FOR OXIDATION AND REDUCTION OF INORGANIC NITROGEN,

Tokyo Univ. (Japan). Ocean Research Inst.

T. Miyazaki, E. Wada, and A. Hattori.

Deep-Sea Research and Oceanographic Abstracts, Vol 20, No 6, p 571-577, June 1973. 4 fig, 3 tab, 6 ref.

Descriptors: \*Nitrogen, Shallow water, \*Sea water, \*Radioactivity techniques, \*Oxidation, \*Reduction (Chemical), \*Path of pollutants, Inorganic compounds, Nitrates, Nitrates, Ammonia, Absorption, Chemical analysis, Water analysis, Tracers, Methodology, Water sampling, Mass spectrometry, Pollutant identification.

Identifiers: \*Japan (Sagami Bay), N-15, Coastal waters, Fate of pollutants, Chemical recovery, Kjeldahl procedure.

The distribution of nitrite, nitrate and ammonia in Sagami Bay, Japan, was investigated on Cruises KT-70-5 and KT-70-13 of the R.V. Tansei Maru. The purpose was to estimate the capacity of coastal waters for the oxidation and reduction of inorganic nitrogen by measuring the incorporation of N-15 into nitrite from N-15-labeled ammonia and nitrate. N-15-labeled ammonia, nitrite or nitrate was added at 10 microgram-atoms N/l concentrations to water samples in glass bottles some of which were incubated in the sunlight or in the dark. N assimilation was measured on filtered residues by Kjeldahl digestion. N-15 incorporation into nitrite was determined using azo dyes along with Kjeldahl digestion and N-15 content by mass spectrometry. Chemical analyses for nitrate, nitrite and ammonia were carried out by previously described methods. In summer, the maximum concentration of nitrite (about 0.3 microgram atoms N/l in central Sagami Bay) occurred at 20-30 m depth and was associated with a seasonal thermocline. In winter, the concentrations of nitrite were nearly constant (about 0.3 microgram atoms N/l) from the surface down to about 100 m; below that depth they decreased. The potential activities for nitrite production from nitrate ammonium were measured, using a N-15 tracer method. The activity for nitrite production from nitrate was of the same order of magnitude as that from ammonia (1.4 ng atoms N/l/hour, on an average), irrespective of the season. The capaci-

ties for assimilation of inorganic nitrogen in the upper layers (0-50 m) were several times higher than those for the oxidation of ammonia and the reduction of nitrate, but a reverse relation was observed below the euphotic zone. The residence time of nitrite in the upper layers was 7-16 days. (Holoman-Battelle)

W74-00047

#### THE ENVIRONMENTAL FATE OF STRANDED CRUDE OIL.

Woods Hole Oceanographic Institution, Mass.

M. Blumer, M. Ehrhart, and J. H. Jones.

Deep-Sea Research and Oceanographic Abstracts, Vol 20, No 3, p 239-259, March 1973. 5 fig, 6 tab, 11 ref.

Descriptors: \*Environmental effects, \*Weathering, \*Oil spills, Persistence, Aging (Physical), Chemical analysis, Gas chromatography, Microbial degradation, Chemical degradation, Oil pollution, Fossil fuels, \*Massachusetts, Water pollution.

Identifiers: \*Fate of pollutants, \*Crude oil, n-Paraffins, n-Alkanes, Liquid chromatography, Infrared spectrophotometry, Infrared spectra, Petroleum residues, Boiling point, Bermuda, \*Martha's Vineyard (Mass), Wax, Marine environment.

The weathering history of two light paraffinic crude oils which stranded on Martha's Vineyard, Massachusetts, and on Bermuda has been studied over periods of 13 1/2 and 16 months, respectively. The evaporative history of the oils, the microbial utilization of the normal alkanes and other physical and chemical changes involved in the weathering process are described. Oil samples collected from each site were analyzed on temperature-programmed gas chromatographs with 3 percent Apiezon L on Chromosorb W columns. Other analyses included infrared spectrophotometry, liquid chromatography, and ultraviolet analysis. At both locations a considerable and environmentally important fraction of the oil has persisted throughout the entire survey period. The residues are far from being inert asphalts; they remain crude oils, modified by evaporation of the lower boiling components and by partial microbial degradation. The environmental impact of spilled oil depends directly on the magnitude of the standing crop of fossil fuels and on the retention during weathering of specific biologically active oil components. This work demonstrates an unanticipated degree of persistence of oil and of its high boiling components, even under conditions thought favorable to weathering. Wax aggregates in one of the oils suggest that it was derived from tank washings. A survey for wax in open ocean 'tar' should give insight into its sources and the effectiveness of measures to control oil pollution. (Holoman-Battelle)

W74-00049

#### PHOTODECOMPOSITION OF THE HERBICIDE METHAZOLE,

Kentucky Univ., Lexington. Dept. of Entomology.

G. W. Ivie, W. Dorough, and R. A. Cardona.

Journal of Agricultural and Food Chemistry, Vol 21, No 3, p 386-391, May/June 1973. 3 fig, 2 tab, 6 ref.

Descriptors: \*Herbicides, \*Pollutant identification, \*Pesticide toxicity, \*Water analysis, Chlorinated hydrocarbon pesticides, Ultraviolet radiation, Solar radiation, Water, Radioactivity techniques, Chemical analysis, Degradation (Decomposition), Urea pesticides, Mass spectrometry, Methodology, Isolation, Phytotoxicity, Water pollution.

Identifiers: \*Photodecomposition, \*Methazole, \*Metabolites, Degradation products, Photoisomers, Sample preparation, Photodegradation, 3,4-Dichloronitrobenzene, Methanol, Proton magnetic resonance, 1- (3,4-Dichlorophenyl)-3-

methylurea, 1- (3,4-Dichlorophenyl)urea, Infrared spectrophotometry, Dichloro-1-methyl-2-benzimidazolinone, PMR spectra, Infrared spectra, 1- (3,4-Dichlorophenyl)-3-methoxymethylurea, 2- (3,4-Dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione, Mass spectra.

Exposure of methazole (2- (3,4-dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione) to ultraviolet light in methanol or to sunlight in water or as surface deposits resulted in loss of carbon dioxide from the oxadiazolidine ring with subsequent generation of several derivatives. Photoproducts identified include 3,4-dichloronitrobenzene, 1- (3,4-dichlorophenyl)-3-methylurea, 1- (3,4-dichlorophenyl)urea, and two isomeric dichloro-1-methyl-2-benzimidazolinones. The methylurea and urea compounds were not produced in methanol, but 1- (3,4-dichlorophenyl)-3-methoxymethylurea was generated in rather large quantities. This compound degraded to the urea during workup of the photolysis mixture. The two isomeric dichloro-1-methyl-2-benzimidazolinones photoproducts were not phototoxic to bean or tomato foliage, but were more toxic to mice than methazole when administered ip. (Holoman-Battelle)

W74-00050

#### INORGANIC AND ORGANIC PHOSPHORUS DISTRIBUTION IN DOMESTIC AND MUNICIPAL SEWAGE,

Saskatchewan Univ., Saskatoon. Dept. of Soil Science.

P. M. Huang, and C. P. Hwang.

Water and Sewage Works, Vol 120, No 6, p 82-83, June 1973. 1 tab, 7 ref.

Descriptors: \*Phosphorus, \*Domestic wastes, \*Municipal wastes, \*Distribution, \*Pollutant identification, Sewage, Suspended solids, Dissolved solids, Filtration, Nutrient removal, Distillation, Nutrients, Separation techniques, Methodology.

Identifiers: \*Organic phosphorus, Colloidal solids, Membrane filters, Cellulose membranes.

A domestic sewage sample and a municipal sewage sample were examined to determine the distribution of inorganic phosphorus in different size fractions of sewage. Fractionation was carried out by cellulose membrane filtration. Before fractionation, total P, inorganic and organic P content was determined in the less than 3-micron suspension and in the less than 0.025-micron suspension. The amount of total, inorganic and organic phosphorus in sewage decreases with successive filtrations through different size millipore membranes. The percent distribution of total phosphorus in the greater than 3-micron solids, 0.025-3-micron solids and less than 0.025-micron suspension of the samples ranges from 29.40, 5.7 and 53.66, respectively. These separations roughly correspond to suspended solids, colloidal solids and dissolved solids. The percent distribution of inorganic phosphorus in the respective fractions ranged from 19.29, 0.8 and 63.81; that of organic phosphorus ranged from 56.72, 7.17 and 21.27 percent. Inorganic phosphorus was relatively concentrated in the less than 0.025-micron suspension, but it was also present in considerable amount in the greater than 3-micron solids. In contrast to inorganic phosphorus, the content of organic phosphorus in the greater than 3-micron solids was two to more than three times higher than that in the less than 0.025-micron suspension. The total organic phosphorus removed by the filtration with 3-micron and 0.025-micron membranes ranged from 73.79 percent. (Holoman-Battelle)

W74-00055

#### EFFECTS OF PH, LIGHT AND TEMPERATURE ON CARBARYL IN AQUEOUS MEDIA,

Oregon State Univ., Corvallis. Environmental Health Sciences Center.

R. D. Wauchope, and R. Haque.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Sources of Pollution—Group 5B

Bulletin of Environmental Contamination and Toxicology, Vol 9, No 5, p 257-260, May 1973. 1 tab, 11 ref.

Descriptors: \*Degradation (Decomposition), \*Aqueous solutions, Hydrogen ion concentration, Mass spectrometry, Hydrolysis, Solar radiation, \*Carbamate pesticides, Volumetric analysis, Chromatography, Sea water, Solubility.

Identifiers: \*Carbaryl, Thin layer chromatography, Fate of pollutants, Photooxidation, 1-Naphthol, 2-Hydroxy-1,4-naphthoquinone, Lawson, \*Photodegradation.

Degradation of carbaryl in aqueous media was observed under several conditions. The rate of consumption of base was observed using a Radiometer syringe titrator in the pH-stat mode. A 95 percent solution of recrystallized carbaryl was added to distilled water with a pH of 9.0-10.0 for the experiments. Reaction times and second-order rate constants were obtained. Hydrolyses were run in a dark amber glass bottle immersed in water and with temperature and pH closely controlled. A xenon-arc lamp was used to simulate solar radiation of basic solutions of carbaryl in the cavity of a spectrometer. Products were analyzed by mass spectroscopy and thin-layer chromatography. The results show that there is little difference in carbaryl hydrolysis rate constants in NaOH solution vs. seawater. Solubility rates of carbaryl were 114 ppm at 24°C and 67 ppm at 12°C based upon titration rates. In weakly acid solutions, carbaryl and 1-naphthol were stable for weeks in the dark and under laboratory light. Base hydrolysis of carbaryl in the dark leads to formation of 1-naphthol as the only naphthyl product. However, basic 1-naphthol or hydrolyzed carbaryl-solutions turn yellow then amber under laboratory light. Thus, it is the basic form of 1-naphthol, 1-naphthoxide ion, which appears to be especially light sensitive, and photodegradation of this species is probably the most important route for further changes. Products identified in irradiated samples were 1-naphthol and 2-hydroxy-1,4-naphthoquinone (lawson). (Little-Battelle)

W74-00056

**STUDIES IN SWEDEN ON FEASIBILITY OF SOME METHODS FOR RESTORATION OF MERCURY-CONTAMINATED BODIES OF WATER,**  
Swedish Water and Air Pollution Research Lab., Stockholm.

For primary bibliographic entry see Field 05G.

W74-00060

**A REVIEW OF OUTBOARD MOTOR EFFECTS ON THE AQUATIC ENVIRONMENT,**  
Massachusetts Univ., Amherst. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 05C.

W74-00063

**SOME CONSIDERATIONS OF THE CHEMICAL LIMNOLOGY OF MEROMIC TIC LAKE MARY,**  
Wisconsin Univ., Madison. Water Chemistry Program.

For primary bibliographic entry see Field 05C.

W74-00064

**NOXIOUS SUBSTANCES CONTAINED IN THE WATERS: THEIR ORIGIN, BEARING, AND THEIR ELIMINATION, (IN GERMAN),**  
Mainz Univ. (West Germany). Hygiene Institut. J. Bornhoff.

Zentralbl Bakteriol Parasitenkd Infektionskr Hyg Erste Abt Orig Reihe B Hyg Praev Med. Vol 155, No 3, p 220-230, 1971. English summary.

Identifiers: \*Germany, Human wastes, Nitrates, \*Noxious substances, Reviews, Sewage, Water pollution control, Path of pollutants, Water purification.

Past efforts to control water pollution in Germany are reviewed. Communities and industry are mainly responsible for the major part of water pollution. Both currently discharge insufficiently or non-purified sewage into lakes and rivers. Immediate measures for ground-water protection (marking of protection zones, prevention of accumulation of nitrates) must be taken to ensure perfect quality of drinking water prepared from surface water (general introduction of proved conditioning methods, supplementation of analytic control examinations for trace substances) and for protection of all-round hygienic quality of the surface water (erection of clarification plants). The prevalence and effects of the various noxious substances must be studied to determine specific preventive directions and regulations. Noxious substances known to be particularly hazardous must be replaced by other compounds.—Copyright 1973, Biological Abstracts, Inc.

W74-00065

#### INTERACTION OF YELLOW ORGANIC ACIDS WITH CALCIUM CARBONATE IN FRESH-WATER,

Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.

A. Otsuki, and R. G. Wetzel.

Limnology and Oceanography, Vol 18, No 3, p 490-493, May 1973. 2 fig, 1 tab, 18 ref.

Descriptors: \*Calcium carbonate, Freshwater, \*Organic matter, \*Separation techniques, \*Chemical precipitation, Humic acids, Organic acids, Adsorption, Chemical reactions, Pollutants, Hydrogen ion concentration, Hardness (Water), Methodology, Chemical analysis, Water analysis.

Identifiers: \*Yellow humic acids, Chemical recovery, Sample preparation.

That refractory dissolved organic matter can be removed naturally from lake waters as  $\text{CaCO}_3$  precipitates has been examined. Adsorption experiments involving yellow humic acids were done by inducing  $\text{CaCO}_3$  precipitation from homogeneous systems. Carbon-14 yellow acids were prepared from the experimental decomposition of a C-14-labeled aquatic plant (Scirpus subterminalis). Experimental water was collected from the mouth of an inlet stream which dominates the total monthly Ca ion input to Lawrence Lake throughout the year. More than 30 percent of yellow acids were removed from solution along with  $\text{CaCO}_3$  precipitation. The pH of each solution increased with time from the initial 8.4 to 9.0-9.1, suggesting that  $\text{CaCO}_3$  precipitation occurred with the release of  $\text{CO}_2$  from  $\text{Ca}(\text{HCO}_3)_2$  rather than as the result of supersaturation of  $\text{CaCO}_3$ . The results show that large amounts of soluble humic substances are removed from lake water with  $\text{CaCO}_3$ . It was found that the yellow acids behave like lipid material with respect to association with  $\text{CaCO}_3$  particles. (Holoman-Battelle)

W74-00070

#### ORGANOCHLORINE INSECTICIDE RESIDUES IN STREAMS DRAINING AGRICULTURAL, URBAN-AGRICULTURAL, AND RESORT AREAS OF ONTARIO, CANADA - 1971,

Department of Agriculture, London (Ontario). Research Inst.

J. R. W. Miles, and C. R. Harris.

Pesticides Monitoring Journal, Vol 6, No 4, p 363-368, March 1973. 2 fig, 3 tab, 6 ref.

Descriptors: \*Chlorinated hydrocarbon pesticides, \*Drainage water, \*Pollutant identification, \*Pesticide residues, Insecticides, Chemical analysis, Bottom sediments, Urban runoff, Agricultural runoff, Recreation wastes, Drainage area, Pollutants, Water analysis, DDT, DDD, DDE, Dieldrin, Endrin, Heptachlor, Aldrin, Insecticides, Gas chromatography, Solvent extractions, Brown trout, Rainbow trout, Rock bass, Carp, Bass, Lake trout, Cisco.

Identifiers: Electron capture gas chromatography, Trace levels, Chemical recovery, Sample preparation, Biological magnification, Animal tissues, Bioaccumulation, TDE, Endosulfan, gamma-Chlordane, Lindane, Heptachlor epoxide, Muskoka River, Muskoka Lakes, Thames River, Gas liquid chromatography, Animal tissues, Bluegills, Salmo trutta, Salmo gairdneri, Amblepus rupestris, Cyprinus carpio, White sucker, Catostomus commersoni, Salvelinus namaycush, Aroclor 1254, Chemical interference, Coregonus artedii, \*Canada (Muskoka River).

Organochlorine insecticide residues in water systems draining agricultural, urban-agricultural, and resort areas of Ontario, Canada, were compared by analysis of water, bottom mud, and fish, collected during the period from mid-April to mid-October 1971. Insecticides detected by electron capture gas chromatography were  $p,p'$ -DDT,  $o,p'$ -DDT,  $p,p'$ -TDE,  $o,p'$ -TDE,  $p,p'$ -DDE, gamma-chlordane, dieldrin, endrin, endosulfan, heptachlor, heptachlor epoxide, lindane, and aldrin. Insecticide concentrations in water from all three areas were less than the 'Maximum Reasonable Stream Allowances' for growing fish that are safe for human consumption. The concentrations of total DDT in the water were combined with water flow data to calculate the weekly rate of transport of total DDT at each sampling time. The greatest transport of total DDT was by the Muskoka River which drains the Muskoka Lakes resort area where DDT was used until 1966 for control of biting flies; a peak of 11.8 lb total DDT per week was recorded in May, but this transport quickly lessened, resulting in a May to October average of 1.9 lb total DDT per week. Corresponding figures for the Thames River (urban-agricultural) were peak 2.5 lb and average 0.4 lb total DDT per week and for Big Creek (agricultural), peak 0.5 lb and average 0.2 lb per week. The ratio of concentration of total DDT in mud to total DDT in water was as great as 800; total DDT in fish to total DDT in water was as great as 1 million. The ratio of  $p,p'$ -TDE to  $p,p'$ -DDT was less than 1 in water but greater than 1 in bottom mud, indicating possible dechlorination of  $p,p'$ -DDT to  $p,p'$ -TDE in the bottom mud. Polychlorinated biphenyls (PCBs) were present in the urban-agricultural area samples of bottom mud and fish at levels up to 217 ppm and about 0.4 ppm, respectively. (Holoman-Battelle)

W74-00070

#### RATE OF EVAPORATION OF LOW-SOLUBILITY CONTAMINANTS FROM WATER BODIES TO ATMOSPHERE,

Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.

D. Mackay, and A. W. Wolkoff. Environmental Science and Technology, Vol 7, No 7, p 611-614, July 1973. 1 tab, 17 ref.

Descriptors: \*Evaporation, Rates, \*Pollutants, Bodies of water, \*Mathematical studies, \*Forecasting, \*Aqueous solutions, Solubility, Equations, Mercury, Aquatic environment, Methodology, Diffusion, Pesticides, Polychlorinated biphenyls, Vapor pressure, Heavy metals, DDT, Dieldrin, Aldrin, Aromatic compounds, Organic compounds, Water pollution, Air pollution, \*Path of pollutants.

Identifiers: \*Hydrocarbons, \*Chlorinated hydrocarbons, Desorption, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260, Lindane, Alkanes, n-Octane, 2,4,4-Trimethylpentane, Aromatic hydrocarbons, Aliphatic hydrocarbons, Benzene, Toluene, o-Xylene, Cumene, Naphthalene, Fate of pollutants.

Equations are derived to predict the rate of evaporation from aqueous solutions of compounds such as hydrocarbons and chlorinated hydrocarbons which are of low solubility. The rate of evaporation can be high even for compounds of low vapor pressure and 'half lives' in solution can

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources of Pollution

be as low as minutes or hours under laboratory or environmental conditions. The rate may be limited by diffusion or desorption. Transfer of contaminants from the water to air environments may thus occur much faster than has been generally appreciated. (Holoman-Battelle)  
W74-00071

**BASELINE CONCENTRATIONS OF LIGHT HYDROCARBONS IN GULF OF MEXICO,**  
Texas A and M Univ., College Station. Dept. of Oceanography.  
J. M. Brooks, A. D. Fredericks, W. M. Sackett, and J. W. Swinnerton.  
Environmental Science and Technology, Vol 7, No 7, p 639-642, July 1973. 5 fig, 2 ref.

Descriptors: Surface waters, \*Gulf of Mexico, \*Baseline studies, \*Sea water, Water analysis, Water quality, \*Pollutant identification, Organic compounds, Gases, Methane, Chemical analysis, \*Gas chromatography, Water pollution sources. Identifiers: \*Hydrocarbons, Marine environment, Flame ionization gas chromatography.

A 2500-mile survey of light hydrocarbon concentrations in surface water of the Gulf of Mexico was conducted to determine baseline concentrations for a program to identify problems related to oceanic environmental quality. Analyses of the light hydrocarbons were carried out by flame ionization gas chromatography. High concentrations seem to be associated solely with man's activities in the vicinity of ports and offshore petroleum drilling and production operations and in one case on the high seas, near a tanker reportedly discharging 'clean ballast water'. (Holoman-Battelle)  
W74-00073

**GROUND-WATER NITRATE POLLUTION IN RURAL AREAS,**  
Illinois State Water Survey, Urbana.  
W. H. Walker.  
Ground Water, Vol 11, No 5, p 19-22, September-October 1973. 2 fig, 3 ref.

Descriptors: \*Path of pollutants, \*Nitrates, \*Groundwater, Farm wastes, Fertilizers, Waste disposal, Groundwater movement.

In humid regions, chemical pollutants such as nitrate readily enter surficial aquifers as slugs during recharge periods in the nongrowing season and move slowly through the aquifer to nearby drainage tiles, streams, or pumping wells. Little mixing with native groundwater seems to occur, and for this reason, fairly small quantities of pollution may enter a well as a high-concentration slug long after its initial entry into the aquifer. Nitrate slug concentrations in excess of 6,000 ppm have been delineated in one surficial aquifer in Illinois. Trees and plants may temporarily store large quantities of nutrients during the growing season for release to aquifers during subsequent nongrowing seasons. Considering this, it appears imperative that farm fertilizer application and waste disposal on farmlands be limited to the growing season and only in quantities that will not ultimately cause groundwater nitrate concentrations to rise above toxic levels. (Knapp-USGS)  
W74-00095

**A MODEL FOR CHEMICAL EXCHANGE IN THE BASALT-SEAWATER SYSTEM OF OCEANIC LAYER II,**  
Oregon State Univ., Corvallis. School of Oceanography.  
For primary bibliographic entry see Field 02K.  
W74-00097

**POLLUTION OF AIR, WATER, AND SOIL BY LIVESTOCK,**  
Agricultural Research Service, Lincoln, Nebr.

For primary bibliographic entry see Field 05G.  
W74-00128

W74-00237

**CHARACTERISTICS OF ANIMAL WASTES AND RUNOFF,**  
Agricultural Research Service, Lincoln, Neb.  
For primary bibliographic entry see Field 05G.  
W74-00131

**POLLUTION OF AIR, WATER AND SOIL BY LIVESTOCK,**  
Agricultural Research Service, Lincoln, Nebr.  
For primary bibliographic entry see Field 05G.  
W74-00135

**CHARACTERISTICS OF LIVESTOCK WASTE AND RUNOFF,**  
Agricultural Research Service, Lincoln, Nebr.  
For primary bibliographic entry see Field 05G.  
W74-00138

**NITROGEN SOURCES AND CYCLING IN NATURAL WATERS,**  
Florida Univ., Gainesville. Dept. of Environmental Engineering.  
For primary bibliographic entry see Field 05C.  
W74-00149

**OCCURRENCE AND DISTRIBUTION OF HELMINTH PARASITES OF FISHES FROM LAKE CARL BLACKWELL, OKLAHOMA,**  
Oklahoma State Univ., Stillwater.

R. D. Spall.  
Available from the National Technical Information Service as COM-72-11082, \$3.00 in paper copy, \$1.45 in microfiche. M.S. thesis supported by National Marine Fisheries Service, Report NOAA-72070613, July 1968. 108 p, 6 fig, 20 tab, 179 ref. 4-24-R.

Descriptors: \*Fish parasites, \*Hosts, \*Worms, Fish, Fish diets, Systematics, Distribution, Nematomides, Trematodes, \*Oklahoma.  
Identifiers: \*Helminths, Lake Carl Blackwell (Okla), South Central U.S.

The endoparasitic helminths of fishes in Lake Carl Blackwell, Oklahoma, were surveyed, and to what degree certain environmental factors can be correlated with variations in the prevalence and intensity of parasitism determined. Channel catfish (*Ictalurus punctatus*) and white crappie (*Pomoxis australis*), because of constant availability, were selected for analysis together with other fish species collected during summer. The incidence and intensity of fish infection with helminth parasites varied considerably among different hosts. Certain habitat features such as high turbidity and absence of aquatic macrophytes probably limited many Trematoda. Host age appears to have far-reaching effects on parasitism in natural infections. Physiological and immunological changes resulting from the aging process appeared to influence their helminthocenoses. The most obvious changes are those associated with gonadal development and sexual maturity. Data seem to show that ontogenetic changes in the feeding behavior of the host are perhaps even more important. Seasonal variation in incidence and severity of helminth parasitism, especially those utilizing fish as definitive hosts, was probably influenced by the annual life cycle of the parasite. Changing food habits of the host has been cited to explain observable differences in its helminth fauna. (Jones-Wisconsin)  
W74-00230

**SOIL DENITRIFICATION IN SEALED SOIL-PLANT SYSTEMS: I. EFFECT OF PLANTS, SOIL WATER CONTENT AND SOIL ORGANIC MATTER CONTENT,**  
Adelaide Univ. (Australia). Dept. of Agricultural Biochemistry and Soil Science.  
For primary bibliographic entry see Field 02G.

**HYGIENIC EFFICACY OF SANITARY PROTECTION MEASURES FOR SURFACE WATERS IN THE REGION OF OIL-REFINING AND OIL-CHEMICAL ENTERPRISES, (IN RUSSIAN),**  
Nauchno-Issledovatel'skii Institut Gigieny i Profzabolelenii, Ufa (USSR).  
F. G. Murzakaev.  
Gig Sanit. Vol 37, No 7, p 15-18. 1972. (English summary).  
Identifiers: \*Chemical wastes, Hygienic protection, \*Oil wastes, \*Sanitary protections, Surface waters, Industrial wastes, \*USSR (Belaya River).

A complex of sanitation measures (technologic, sanitary-technical, organizational, etc.) was carried out by oil-refining and oil-chemical enterprises of a large industrial center for the sanitary protection of surface waters. Consequently, down current of the river Belaya, a significant fall in contamination was noted at the water uptake sites for the municipal water supply. Further sanitation measures should stipulate a more intense decontamination of sewage containing oil and organic substances by local and biological treatment installations. In such cases after biological decontamination, the effluents should undergo a number of additional treatments to diminish the concentration of residual organic and cancerogenic compounds. Copyright 1973, Biological Abstracts, Inc.  
W74-00241

**NITRATE CONTENT OF WELL WATER IN WEST-CENTRAL WISCONSIN,**  
Wisconsin Univ., River Falls.  
M. W. Wehking, J. W. Pavlik, P. Streg, and D. Gilles.  
Wisconsin Academy of Sciences, Arts and Letters, Vol 61, p 259-265, 1973. 1 fig, 4 tab, 11 ref.

Descriptors: \*Potable water, \*Water pollution sources, \*Nitrates, \*Wells, \*Wisconsin, Depth, Limestones, Groundwater, Spectrophotometry, Fertilizers, Coliforms, Water analysis.  
Identifiers: Pierce County (Wis.), St. Croix County (Wis.).

Concern over nitrate content of drinking water, particularly from groundwater sources, prompted survey of wells in Pierce and St. Croix Counties, Wisconsin. Nitrate content of 124 wells was determined. None of the well water samples contained iron sufficient to affect analysis. Nitrate content of these wells varied widely, the majority containing concentrations of less than 20 ppm. Twenty of the wells (16.5%) yielded water containing nitrate in excess of 45 ppm. The data acquired from those wells for which depths were known were examined for relationship between well depth and nitrate content. Although the correlation was not perfect, the summarized data indicate that as well depth increased, the average nitrate content decreased. In areas underlain by limestone, faults in the subterranean structure allow surface water to reach depths of several hundred feet quite rapidly. No conclusions were reached from the results as to origin of nitrate in ground water. However, greater probability exists of finding excessive quantities of nitrate beyond 45 ppm. in shallow wells less than 150 ft than in deep wells greater than 150 ft. (Jones-Wisconsin)  
W74-00246

**ISOMERIZATION OF GAMMA-BHC TO ALPHA-BHC IN THE ENVIRONMENT,**  
Wisconsin Univ., Madison. Dept. of Entomology.  
H. J. Benezet, and F. Matsumura.  
Nature, Vol 243, No 5408, p 480-481, June 22, 1973. 1 fig, 10 ref.

Descriptors: \*Microbial degradation, \*Sediments, \*Metabolism, Cultures, Gas chromatography, Separation techniques, Soil bacteria.

Identifiers: \*Benzene hexachloride, \*Isomerization, Pseudomonas putida, Lindane, Fate of pollutants, Isomers, Alpha-benzene hexachloride, Gamma-benzene hexachloride, Degradation products, Metabolites, Gamma-pentachlorocyclohex-1-ene, Gamma-tetrachlorocyclohex-1-ene.

To study the metabolic fate of gamma-BHC in the environment, a highly purified form of the compound was incubated with aquatic sediments under simulated natural conditions and with a soil microorganism under laboratory conditions. For the first test, the gamma-BHC was added to sediments from Pearl Harbor, placed in a medicine bottle which was then filled with seawater and sunk to the bottom at the collection site for 30 d. At the end of the period, the sediment was extracted and the extract analyzed by GC. Alpha-BHC was present in quantities 4 times that found in the original quantity of gamma-BHC. Total recovery of the gamma isomer from the sediment was 40 percent. For the laboratory study, a strain of Pseudomonas putida in a mannitol base medium was incubated with gamma-BHC and NAD for 4 weeks. Concurrently small-scale experiments were conducted with C-14-labelled BHC and *P. putida* with and without NAD. In the culture tests with NAD, 40 times as much alpha-BHC was present as originally. With the C-14-labelled BHC, *P. putida* was found to produce gamma-PCCH (gamma-pentachlorocyclohex-1-ene) from gamma-BHC, but was capable of producing alpha-BHC with NAD present. Another metabolic product of alpha-BHC production was gamma-BTC (gamma-tetrachlorocyclohex-1-ene). It is concluded that microorganisms in the environment may isomerize gamma-BHC to alpha-BHC. (Little-Battelle) W74-00264

**ASSOCIATION OF HYDROCARBONS AND MINERAL PARTICLES IN SALINE SOLUTION, Rhode Island Univ., Kingston. Graduate School of Oceanography.**

P. A. Myers, and J. G. Quinn.  
Nature, Vol 244, No 5410, p 23-24, July 6, 1973. 3 tab, 11 ref.

Descriptors: \*Sediments, \*Adsorption, \*Clays, Illite, Montmorillonite, Bentonite, Oil spills, Path of pollutants, Toxicity, Water pollution effects, Organic matter, Solubility, Sea water, \*Rhode Island, \*Organic compounds.

Identifiers: \*Fuel oil, Eicosane, Hexadecane, Anthracene, Phenanthrene, Fate of pollutants, Heat of sorption, n-Alkanes, Branched alkanes, Isoprenoid hydrocarbons, Aromatic hydrocarbons, Naphthalene hydrocarbons, \*Narragansett Bay (R.I.).

Bentonite clay or marine sediments from Narragansett Bay were added to saline solutions containing hydrocarbons (eicosane, Hexadecane, anthracene, phenanthrene, or fuel oil) dissolved in acetone to study the sorption of hydrocarbons on the minerals. The marine sediments were tested with and without organic matter separated. The heats of sorption of eicosane and anthracene onto bentonite clay indicated physical absorption to be of the van der Waals type. The results of the sorption tests show that hydrocarbon solubility affects uptake and retention of fuel oil by marine sediments and that organic matter in sediments reduces the incorporation of fuel oil into the sediment samples investigated. Although the compounds are firmly associated onto the mineral particles, they may be slowly released by biological activity and dissolution. If dissolution were dominant, the more polar hydrocarbons, which are toxic, would be released more readily and could impose a continuing stress on marine organisms long after visual evidence of oil production has disappeared. (Little-Battelle) W74-00265

**THE INFLUENCE OF AN INDUSTRIAL PLANT ON THE CHEMISTRY OF QUATERNARY WATERS IN ITS VICINITY, UPPER ODRA RIVER VALLEY, (IN POLISH),**

Academy of Mining and Metallurgy, Krakow (Poland). Inst. of Hydrogeology and Engineering Geology.

For primary bibliographic entry see Field 05A.  
W74-00266

**DEGRADATION OF PARATHION IN FLOODED ACID SOILS,**

Central Rice Research Inst., Cuttack (India).

N. Sethunathan.

Journal of Agricultural and Food Chemistry, Vol 21, No 4, p 602-604, July/August 1973. 1 fig, 4 tab, 29 ref.

Descriptors: \*Insecticides, \*Phosphothioate pesticides, \*Acidic soils, \*Chemical degradation, \*Pesticide residues, \*Microbial degradation, Soil bacteria, Hydrolysis, Soil analysis, Laterites, Saline soils, Alluvium, Biodegradation, Degradation (Decomposition), Organophosphorus pesticides, Solvent extractions, Methodology, Isolation, Chemical analysis, Soil contamination.

Identifiers: \*Parathion, Flooded conditions, Degradation products, p-Nitrophenol, Chemical recovery, Metabolites, *Bacillus*, Sample preparation, Thin layer chromatography.

The persistence of parathion (0,0-diethyl 0-(p-nitrophenyl) phosphorothioate) in five acid soils under flooded conditions was investigated. Parathion residues were prepared for analysis by thin-layer chromatography by extraction with 1:1 chloroform-diethyl ether, evaporation to dryness and dissolution in methanol. To determine if the degradation in acid sulfate soil were biological or chemical, parathion dissolved in ethanol was added to autoclaved and nonautoclaved soils which were in turn flooded with sterile distilled water. The standing water of alluvial soil which exhibited hydrolytic activity after 3 additions of parathion was analyzed for biological or chemical hydrolysis. The insecticide degraded faster in soils which had a higher organic matter content. Fastest degradation occurred in an acid sulfate soil with an organic matter content of 12.2 percent, apparently due to microbial participation. Repeated additions of parathion to an alluvial soil enhanced its hydrolysis to p-nitrophenol. Heat treatment of the parathion-hydrolyzing enriched culture from the alluvial soil retarded its activity, indicating the role of biological agents in the hydrolysis. A *Bacillus* sp capable of readily decomposing p-nitrophenol as a sole carbon source was isolated from parathion-amended flooded alluvial soil. (Holoman-Battelle) W74-00268

**BIODEGRADABILITY OF NONIONIC SURFACTANTS: SCREENING TEST FOR PREDICTING RATE AND ULTIMATE BIODEGRADATION,**

Procter and Gamble Co., Cincinnati, Ohio. Environmental Water Quality Research Dept.

R. N. Sturm.

Journal of the American Oil Chemists' Society, Vol 50, No 5, p 159-167, May 1973. 12 fig, 29 ref, 1 append.

Descriptors: \*Surfactants, Carbon dioxide, Methodology, \*Microbial degradation, Chemical reactions, Laboratory equipment, \*Biodegradation, \*Detergents.

Identifiers: \*Nonionic detergents.

A method based on conversion to CO<sub>2</sub> and H<sub>2</sub>O has been developed for determining biodegradability characteristics of non-ionic surfactants. The screening test consists of the Thompson-Duthie CO<sub>2</sub> test scaled down from 20 to 6 liters, and a biochemical oxygen demand test performed with acclimated sewage-derived microorganisms. The CO<sub>2</sub> test apparatus is arranged in such a manner that eight materials and a positive control may be

tested simultaneously. Nine individual acclimation cultures—each combining settled raw sewage as a source of microorganisms, yeast extract as an easily assimilable nutrient source, BOD water as a diluent and source of inorganic nutrients, and a test material for 14 days. At the end of that time, equal aliquots from each of these cultures are used to make a composite seed for use in the CO<sub>2</sub> test. The final composition in each carboy includes 600 ml of composite seed and 120 mg of a test material brought to a total of 6 liters with BOD water. During the test CO<sub>2</sub>-free air is bubbled through a series of CO<sub>2</sub> absorbers containing barium hydroxide. Periodically, the proximal absorber is removed for titration. The test is continued for a period of 26 days. At day 25, the test vessels are acidulated to pH 3.0 in order to release CO<sub>2</sub> that may be trapped in the medium. A wide range of nonionic surfactants have been screened for biodegradability by this method, and the results, in general, correlate well with those of other investigators. These have included studies of the effect of hydrophobe chain length, ethoxyate chain length, and the presence of phenolic groups on biodegradability. The method should lend itself to measuring degradation under conditions of anaerobiosis or low temperature. (Little-Battelle) W74-00269

**DISPERSION AND TRANSPORT OF RHODAMINE B DYE AND METHOXYCHLOR IN RUNNING WATER: A PRELIMINARY STUDY,**

Queen's Univ., Kingston (Ontario). Dept. of Biology.

R. R. Wallace, W. F. Merritt, and A. S. West. Environmental Pollution, Vol 5, No 1, p 11-18, July 1973. 2 fig, 24 ref.

Descriptors: (\*Pesticide kinetics, \*Dye dispersion, \*Monitoring, \*Path of pollutants, Running waters, Chlorinated hydrocarbon pesticides, Fluorescent dye, Pesticide residues, Water analysis, Pollutant identification, Insecticides, Rhodamine, Fluorometry, Chemical analysis, Pollutants).

Identifiers: \*Rhodamine B, \*Methoxychlor, Chemical indicators, Organic dyes, Gas liquid chromatography, Tetraethyl di-amino-o-carboxyphenyl-xanthenyl chloride, 1 1 1-Trichloro-2 2-bis (p-methoxyphenyl)ethane.

A study was carried out to ascertain if the fluorescent dye Rhodamine B (tetraethyl di-amino-o-carboxy-phenyl-xanthenyl chloride) could be used as an indicator for the insecticide methoxychlor (1,1,1-trichloro-2,2-bis (p-methoxyphenyl)ethane) which, when used as an emulsifiable concentrate against blackfly larvae, disperses readily in running water. Two streams north of Baie Comeau, Quebec, were used with the chemicals being administered to fast water riffles in both streams. Concurrent insecticide-Rhodamine B treatment and experiments with Rhodamine B alone were carried out. A submersible sampling pump was placed mid-channel near the bottom of the stream to ensure a constant flow of about 12 l/min to the fluorometer. Readings were recorded at minute intervals and the insecticide residue content in water samples was determined by fluorometry and gas-liquid chromatography. The arrival times for the peak concentration of dye were quite different in the 2 streams at roughly equivalent distances downstream. However, the results have shown that the dye can provide useful information for planning future larvicide treatments and can form a basis for monitoring insecticide concentrations downstream from ground-level application sites, or for predicting effects in other streams of similar character in advance of actual or potential loadings. (Holoman-Battelle) W74-00279

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources of Pollution

#### PHOTOLYSIS OF THE HERBICIDE DINITRAMINE (N3,N3-DIETHYL-2,4-DINITRO-6-TRIFLUOROMETHYL-M-PHENYLEDIAMINE),

United States Borax Research Corp., Anaheim, Calif.

H. C. Newsom, and W. G. Woods.

Journal of Agricultural and Food Chemistry, Vol 21, No 4, p 598-601, July/August 1973. 2 fig, 1 tab, 10 ref.

Descriptors: \*Herbicides, Halogenated pesticides, Solar radiation, Aqueous solutions, Water analysis, Pollutant identification, Methodology, Degradation (Decomposition), Chemical analysis, Gas chromatography, Mass spectrometry, Nuclear magnetic resonance.

Identifiers: \*Degradation products, \*Dinitramine, \*Photodegradation, \*Degradation rates, \*Photolysis, Methanol, Fate of pollutants, Photodecomposition, Metabolites.

The degradation rate and products of the photolysis of the herbicide dinitramine (N3,N3-diethyl-2,4-dinitro-6-trifluoromethyl-m-phenylenediamine) in methanol and in water were investigated. Of concern also were sunlight degradation of aqueous dinitramine, the sunlight irradiation of dinitramine in natural waters and on sand, photolysis of C-14-labeled dinitramine in water, and the photolysis of 5-amino-1,2-dihydroxy-3-ethyl-2-ethyl-4-nitro-6-trifluoromethylbenzimidazole. The compound was found to degrade rapidly through reductive cyclization of a nitro group and an adjacent N-ethyl group to give the following products: 6-amino-1-ethyl-2-methyl-7-nitro-5-trifluoromethylbenzimidazole; 5-amino-1,2-dihydroxy-3-ethyl-2-methyl-4-nitro-6-trifluoromethylbenzimidazole; 1-ethyl-6-hydroxyamino-2-methyl-7-nitro-5-trifluoromethylbenzimidazole; and 6-amino-2-methyl-7-nitro-5-trifluoromethylbenzimidazole. (Holoman-Battelle) W74-00292

#### MERCURY: ENVIRONMENTAL CONSIDERATIONS, PART I,

Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering. For primary bibliographic entry see Field 05C.

W74-00292

#### PROTEIN ADSORPTION BY SUSPENDED SEDIMENTS: EFFECTS OF PH, TEMPERATURE, AND CONCENTRATION,

Alaska Univ., College. Inst. of Water Resources.

A. P. Murray.

Environmental Pollution, Vol 4, No 4, p 301-312, June 1973. 6 fig, 2 tab, 9 ref. OWRR A-030-ALAS (3).

Descriptors: \*Proteins, \*Adsorption, Aquatic environment, \*Suspended solids, \*Sediments, \*Environmental effects, Water temperature, Hydrogen ion concentration, Variability, Soil analysis, Water analysis, Bottom sediments, Bottom sampling, Water sampling, Chemical analysis, Aquatic soils, Colorimetry, \*Alaska, Kaolinite, Illite, Montmorillonite, Particle size, Clay minerals, Path of pollutants.

Identifiers: Natural waters, Chemical concentration, Characterization, Fate of pollutants, Sample preparation, Tanana River, Lowe River, Knik Arm, Bovine serum albumin.

The affinities of sediment materials from various natural, silt-laden waters in Alaska, and their variation with pH, temperature and protein concentration, were determined for the protein bovine serum albumin. Water and bottom soil samples were collected from Alaskan river systems in summer and autumn. The water samples were characterized in terms of the particle size distributions of their suspended matter and the soil samples were characterized before their use in adsorption experiments. The sediment sample or

reference sample for the adsorption experiments was placed in an Erlenmeyer flask to which was added a temperature-equilibrated solution of the protein in distilled water or buffer solution. The flask was capped, contents mixed, set in an incubator-shaker and shaken at 200 rpm on a rotary motion shaker at a known temperature for at least 24 h. To determine the amount of protein remaining in solution at equilibrium, an aliquot of the suspension was centrifuged and the supernatant was analyzed for protein by the Folin-Ciocalteu colorimetric method. As expected, the pH of the water system plays an important role in the amount of the protein bovine serum albumin adsorbed by suspended sediments. For the soil materials studied, maximum adsorption was observed at pH 3; minimum at pH 6.5. The behavior of the Alaskan sediments in this respect was similar to that of kaolinite and montmorillonite but unlike that of illite. From experiments in which the adsorptive capacities of the sediments were measured as a function of the initial amount of protein, it was found that the equilibrium concentration of protein remaining in solution could be related to the initial protein:sediment ratio by the equation:  $c = k \cdot P^{\frac{1}{n}}$  where  $c$  is the equilibrium concentration,  $P$  is the initial protein concentration,  $k$  is a constant, and  $n$  is the power. Variations in temperature from 5°C to 25°C had no detectable effect on the amount of protein adsorbed. The amount of protein adsorbed (at the pH of the natural water systems) on to suspended sediments would have a negligible effect on the rate at which the protein would be decomposed in the aqueous environment. (Holoman-Battelle) W74-00293

#### TOXIC MATERIALS ANALYSIS OF STREET SURFACE CONTAMINANTS,

URS Research Co., San Mateo, Calif.

R. E. Pitt, and A. Gary.

Copy available from GPO Sup Doc as EPI.23/2:73-283, \$1.55; microfiche from NTIS as PB-224 677, \$1.45. Environmental Protection Agency, Technology Series Report EPA-R2-73-283, August 1973. 143 p, 10 fig, 67 tab, 61 ref. EPA Project 11034 FUJ.

Descriptors: \*Storm runoff, \*Surface runoff, \*Urban runoff, Pollution (Water), Solids, \*Heavy metals, Biochemical oxygen demand, Chemical oxygen demand.

Identifiers: Street cleaning, \*Street-surface contaminants.

Because of the large amounts of toxic materials (especially heavy metals) found associated with street surface particulates during the course of a previous study (Water Pollution Aspects of Street Surface Contaminants), additional work has recently been completed which defines the distribution and range of heavy metals on the Nation's city streets. This project defined the breakdown of the particulates' compositions by having mass spectrophotographic analyses performed on various samples. Using these results, the heavy metals which were determined to have the greatest water pollution potential (As, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Sr, Ti, Zn, and Zr) were analyzed in each of about 75 samples collected nationwide in 10 cities in the previous study. (See also W73-06212) (EPA) W74-00306

#### SALINITY STUDIES IN EAST GLADES AGRICULTURAL AREA, SOUTHEASTERN DADE COUNTY, FLORIDA,

Geological Survey, Tallahassee, Fla.

For primary bibliographic entry see Field 03C.

W74-00329

#### WATER-SALT BALANCE OF GROUNDWATER IN THE GOLODNOY STEPPE IN 1969 (VODNO-SOLEVOY BALANS PODZEMNYKH VOD GOLODNOY STEPPI ZA 1969 GOD),

Ministerstvo Geologii, Tashkent (USSR).

For primary bibliographic entry see Field 04B. W74-00340

#### HYDROGEOLOGICAL BASIS FOR PROTECTION OF GROUNDWATER AND WATER WELLS FROM POLLUTANTS (GIDROGEOLOGICHESKOE OBOSNOVANIYE ZASHCHITY PODZEMNYKH VOD I VODOZABOROV OT ZAGRYAZNENIY),

F. M. Bochever, and A. Ye. Oradovskaya.

Izdatel'stvo 'Nedra', Moscow, 1972. 129 p.

Descriptors: \*Water pollution, \*Pollutants, \*Path of pollutants, \*Groundwater, \*Water wells, Industrial wastes, Waste disposal, Waste storage, Waste water (Pollution), Aquifers, Movement, Flow, Diffusion, Dispersion, Sorption, Forecasting, Laboratory tests, On-site tests, Dye releases, Equations.

Identifiers: USSR, Dye tracer studies.

Pollution of groundwater by industrial wastes and fundamentals of a theory of pollutant movement in groundwater are examined. Methods are presented for calculating flow from waste disposal pits and flow to water wells, for forecasting pollutant travel in aquifers, and for determining physicochemical parameters of pollutant migration in groundwater under laboratory and field conditions. (Josefson-USGS) W74-00347

#### SOME ASPECTS OF THE HYDRODYNAMIC DISPERSION OF SOLUTES IN POROUS MATERIALS,

Rothamsted Experimental Station, Harpenden (England).

For primary bibliographic entry see Field 02G.

W74-00360

#### DISPERSION-AFFECTED TRANSPORT OF REACTING SOLUTES IN SATURATED POROUS MEDIA: GALERKIN METHOD APPLIED TO EQUILIBRIUM-CONTROLLED EXCHANGE IN UNIDIRECTIONAL STEADY WATER FLOW,

Geological Survey, Menlo Park, Calif.

J. Rubin, and R. V. James.

Water Resources Research, Vol 9, No 5, p 1332-1356, October 1973. 7 fig, 22 ref.

Descriptors: \*Dispersion, \*Ion exchange, \*Ion transport, \*Groundwater movement, Path of pollutants, Water chemistry, Mass transfer, Solutes, Chemical reactions, Saturated flow, Translocation, Leaching, Mathematical studies, Numerical analysis.

Identifiers: \*Galerkin method.

Equations describing dispersion and ion exchange in one-dimensional transport of solutes in saturated porous media may be solved numerically by means of the Galerkin method. It is assumed that water flow is steady and that local chemical equilibrium exists throughout the systems considered. No constancy restrictions are placed on the total concentration of the dissolved ions participating in exchange. The cases treated involve (1) homogeneous or layered systems, (2) exchange reactions with constant or concentrations dependent selectivity coefficients, (3) binary or multicomponent exchange, and (4) systems in which one of the exchanging ions is also involved in a precipitation-dissolution reaction. The approach may be useful in analyzing a variety of solute transport processes of hydrologic interest. (K-napp-USGS) W74-00364

#### EXPERIMENTAL AND MATHEMATICAL MODELING OF LIQUID-LIQUID MISCIBLE DISPLACEMENT IN POROUS MEDIA,

Kansas Univ., Lawrence. Dept. of Chemical and Petroleum Engineering.

For primary bibliographic entry see Field 02F.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Sources of Pollution—Group 5B

W74-00366

**DISPERSION DURING FLOW IN POROUS MEDIA WITH BILINEAR ADSORPTION,**  
Purdue Univ., Lafayette, Ind. School of Chemical Engineering.  
S. P. Gupta, and R. A. Greenkorn.  
Water Resources Research, Vol 9, No 5, p 1357-1368, October 1973. 4 fig, 1 tab, 27 ref.

Descriptors: \*Path of pollutants, \*Dispersion, \*Groundwater movement, Numerical analysis, \*Adsorption, Porous media, Farm wastes, Industrial wastes, Fertilizers, Pesticides, Herbicides, Water pollution sources.

Major sources of pollution in underground water come from the runoff of cattle feedlots, from runoff of fertilizers, pesticides, and herbicides from cultivated lands, and from domestic and industrial wastes. The equations for the dispersion and adsorption of various chemicals in porous media are formulated to calculate pollution movement. If a bilinear rate of adsorption is assumed, two coupled nonlinear parabolic partial differential equations result. The equations can be solved by the Crank-Nicolson method, which is a stable, two-step method. Solutions for the range of variables involved in the movement of pollutants in porous media are obtained for a one-dimensional model. (Knapp-USGS)  
W74-00367

**PICLORAM MOVEMENT FROM A CHAPARRAL WATERSHED,**  
Forest Service (USDA), Tucson, Ariz. Rocky Mountain Forest and Range Experiment Station.  
E. A. Davis, and P. A. Ingebo.  
Water Resources Research, Vol 9, No 5, p 1304-1313, October 1973. 3 fig, 2 tab, 30 ref.

Descriptors: \*Path of pollutants, \*Herbicides, \*Runoff, Pesticide residues, Water pollution sources, Pesticide drift, Translocation, Water yield improvement, \*Arizona, Chaparral, Watershed (Basins).  
Identifiers: \*Picloram.

After a brush control treatment of soil-applied pellets of picloram (9.3 lb acid equivalent per acre) on a 2.1-acre side slope of a 46-acre chaparral watershed in central Arizona, picloram was detected in the stream water at a gaging station at the outlet of the watershed. Maximum measured concentrations (250-370 ppb) occurred during the first 3 months after treatment and were associated with heavy rainfall. After 14 months and 40 inches of accumulated rainfall, picloram was no longer detected in the stream water. An estimated 4.5% of the picloram applied was lost to stream water. Direct use of stream water from the outlet of the treated watershed when picloram levels were 46-370 ppb could have damaged sensitive crops such as cotton. (Knapp-USGS)  
W74-00370

**EFFECT OF AGRICULTURAL MANAGEMENT OF WET SLOPING SOIL ON NITRATE AND PHOSPHORUS IN SURFACE AND SUBSURFACE WATER,**  
Agricultural Research Service, Burlington, Vt. New England Watershed Research Center.  
G. R. Benoit.  
Water Resources Research, Vol 9, No 5, p 1296-1303, October 1973. 3 fig, 3 tab, 13 ref.

Descriptors: \*Nitrates, \*Phosphates, \*Path of pollutants, \*Water pollution sources, \*Fertilizers, Farm wastes, Runoff, Groundwater, Leaching, Infiltration, Drainage water, Subsurface drainage, Drainage practices.

Differences in nitrate and phosphate content of water from three cropping systems were evaluated in a 12-plot study in East Franklin, Vermont, on a

poorly drained, sloping Cabot silt loam: (1) timothy, red clover, Kentucky bluegrass hay-pasture; (3) corn silage. Six plots were in alfalfa hay, six plots were planted in corn, and the up-slope area was in hay-pasture. Soil samples were collected in the summers of 1969 and 1970 and analyzed for total soil nitrogen. Surface and subsurface drain effluent samples from the plots and up-slope area were analyzed for nitrates and phosphates. Draining wet sloping land may decrease total soil nitrogen; nitrate nitrogen may be lost from organic matter breakdown in cold but unfrozen soil; nitrates but not phosphates will move both vertically and laterally through the soil to subsurface drains; surface runoff contains few nitrates but significant concentrations of phosphates; and more nitrates were lost from fertilized corn plots than from alfalfa plots or hay-pasture areas. (Knapp-USGS)  
W74-00371

**ANNUAL CYCLE IN RIVER WATER QUALITY: A TIME SERIES APPROACH,**  
King's Coll., London (England). Rogate Field Center.  
A. M. C. Edwards, and J. B. Thornes.  
Water Resources Research, Vol 9, No 5, p 1286-1295, October 1973. 6 fig, 5 tab, 17 ref.

Descriptors: \*Time series analysis, \*Water quality, \*Streamflow, \*Path of pollutants, Frequency analysis, Statistics, Statistical methods, Variability, Regression analysis, Fourier analysis, Correlation analysis.  
Identifiers: \*River Stour (England).

Regression, spectral, and cross-spectral techniques were used to examine the trends and periodicity in a 20-year record of weekly observations of eight water quality variables in the River Stour, eastern England. Linear regression shows that all except pH and carbonate hardness have significantly increased over time. A strong annual cycle is present. Cross-spectral analysis was used to model the relationship between the variables and the water discharge in time. Nitrate and non-carbonate hardness are positively correlated with discharge, whereas carbonate hardness is an inverse function. (Knapp-USGS)  
W74-00372

**CESIUM 137 IN A MOUNTAIN STREAM CHANNEL,**  
Colorado State Univ., Fort Collins. Dept. of Watershed Sciences.  
J. E. Hubbard, and W. D. Striffler.  
Water Resources Research, Vol 9, No 5, p 1440-1442, October 1973. 1 tab, 6 ref.

Descriptors: \*Radioisotopes, \*Fallout, \*Cesium, \*Alluvium, Sediments, \*Colorado, Path of pollutants, Snowpacks, Snowmelt.

Concentration of the radionuclide Cs-137 in water, sediment, and channel vegetation was determined in a Colorado mountain watershed in 1967. No measurable Cs-137 was found in stream water. Specific Cs-137 activity in sediment decreased exponentially with distance from the headwaters. Its concentration was 124 pc/g at the headwaters, where a snowfield has existed continuously since the atmospheric testing of nuclear weapons, to 4 pc/g 5600 meters downstream. Stream vegetation samples also indicated a similar decrease in specific Cs-137 activity with site location downstream. (Knapp-USGS)  
W74-00376

**LOSS OF PARTICULATE ORGANIC MATERIALS FROM SEMIARID WATERSHEDS AS A RESULT OF EXTREME HYDROLOGIC EVENTS,**  
Utah State Univ., Logan. Watershed Science Unit.  
For primary bibliographic entry see Field 02A.  
W74-00378

**EFFECT OF INSOLUBLE GRAINS ON LEACHATE FROM POROUS BEDS,**  
Syracuse Univ., N. Y. Dept. of Civil Engineering.  
W.-H. Li, and F. H. Feng.  
Water Resources Research, Vol 9, No 5, p 1462-1464, October 1973. 3 fig, 2 ref.

Descriptors: \*Leaching, \*Porous media, \*Path of pollutants, Solubility, Hydraulic models, Waste disposal, Industrial wastes.

Some industrial wastes are composed of soluble and insoluble grains. When such waste is deposited as a waste bed, the soluble material may become a continuous source of pollutant to water. Under certain conditions it is advisable to leach out the soluble material at a controlled rate. As the soluble material is being leached out, the voids and the ratio of the soluble parts to the insoluble parts of the bed change slowly with time. In the leaching of a porous bed composed of soluble and insoluble grains the concentration of dissolved material in the leachate is influenced by the presence of the insoluble material. This influence was studied by modeling the bed as a laminar tube with a wall composed of consecutive soluble and insoluble rings. The presence of the insoluble wall surface has a negligible effect on the leachate if they are less than 50% of the total wall surface. (Knapp-USGS)  
W74-00379

**NUTRIENT LOSSES AFTER CLEAR-CUT LOGGING AND SLASH BURNING IN THE OREGON COAST RANGE,**  
Oregon State Univ., Corvallis. School of Forestry.  
For primary bibliographic entry see Field 04C.  
W74-00381

**AN EVALUATION OF MIXING IN THE TAY ESTUARY,**  
East of Scotland Water Board, Invergowrie (Scotland).  
For primary bibliographic entry see Field 02L.  
W74-00384

**A NUMERICAL MODEL OF THE ST. LAWRENCE RIVER,**  
National Research Council of Canada, Ottawa (Ontario). Hydraulics Lab.  
For primary bibliographic entry see Field 02L.  
W74-00385

**ANALYTICAL MODELING OF ESTUARINE CIRCULATION,**  
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.  
For primary bibliographic entry see Field 02L.  
W74-00386

**MOVEMENT OF POLLUTANT PHOSPHORUS IN SATURATED SOILS,**  
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.  
P. Goodrich.  
PH D Thesis, 1970. 135 p, 57 fig, 3 tab, 49 ref.

Descriptors: \*Path of pollutants, \*Phosphates, Soil contamination, \*Saturated soils, Isotherms, Sand diffusion, \*Adsorption, Clay, \*Soil columns, Radioisotopes, Denitrification, Waste water (Pollution), Electromagnetic waves, Instrumentation, Effluents, \*Irrigation, Water pollution, \*Waste disposal, Nutrients, Farm wastes, \*Monitoring.  
Identifiers: Radioactive tracer solutions, Scintillator, Automatic data collection, Sandy loam, Land disposal, Influent.

A laboratory experiment was carried out using uniform soil columns and radioactive tracer solutions to monitor movement of phosphorus inside soil columns. An electronic data acquisition

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources of Pollution

system was developed to monitor long term study. Results were compared with adsorption models already developed. Simulated high-phosphate irrigation showed the limited capabilities of surface soil in preventing ground water pollution. Sand and sandy loam soils were tested. Results emphasized the importance of clay minerals in phosphate adsorption. However, soils have a finite capacity for adsorbing phosphate, and continuous flushing as in irrigation may cause the phosphate to move quickly to great depths, thus affecting ground water. Therefore, the design of disposal fields must be considered in order to prevent over-accumulation of phosphorus in soil columns. (Frantz-East Central)

W74-00392

#### WATER POLLUTION BY SWINE PRODUCTION OPERATIONS,

North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering. For primary bibliographic entry see Field 05D. W74-00394

#### BIOLOGICAL ASPECTS OF AGRICULTURE'S EFFECTS ON ENVIRONMENTAL QUALITY,

Kentucky Univ., Lexington. Dept. of Entomology. H. W. Dorough. In: Quality of the Environment, Socio-Economic, Biological and Engineering Aspects, Papers presented at the College of Agriculture Annual Conference, University of Kentucky, January 5-7, 1971. p 8-13 (1971).

Descriptors: Agriculture, \*Kentucky, Runoff, \*Farm wastes, Surface waters, \*Insecticides, Toxicity, Soils, Dairy industry, Erosion, Fertilizers, Livestock, Air pollution, Water pollution, \*Soil contamination, Sedimentation, \*Pesticide residues.

Identifiers: Tobacco industry, \*Environmental quality.

Agriculture depends upon maintaining a quality environment. But, it may have various detrimental effects on that environment. The Environmental Quality Task Force in the University of Kentucky College of Agriculture was established to evaluate the following problems: pesticides, sediment, farm wastes and fertilizers. Concentrated pesticide use contaminates surface water, air and especially soil. Erosion and sedimentation aid in the transportation of pollutants in streams. The phosphorus and nitrogen from farm wastes and certain nutrients from fertilizers are major sources of water pollution. Evaluation of the general use of pesticide contamination problem in Kentucky indicates cause for concern, but the situation is not yet critical. (Frantz-East Central)

W74-00396

#### SOIL CONDITIONS UNDER FEEDLOTS AND ON LAND TREATED WITH LARGE AMOUNTS OF ANIMAL WASTES,

Southwestern Great Plains Research Center, Bushland, Tex. B. A. Stewart, and A. C. Mathers. Contribution from Soil and Water Conservation Research Division, Agricultural Research Service, U.S. Department of Agriculture in cooperation with the Texas Agricultural Experiment Station, Texas A and M University (1972). 3 p, 1 tab, 2 fig, 9 ref.

Descriptors: \*Feed lots, \*Farm wastes, \*Water pollution, \*Soil contamination, Cattle, \*Nitrates, \*Pollutants, Soil profiles, \*Waste disposal, Water, Salt, Leaching.

Identifiers: Soil conditions, Croplands.

Nitrate and other pollutants often accumulate in soil profiles under large feedlots. Water movement through these profiles, however, is usually very slow or does not occur, especially in the more arid

areas. A greater pollution hazard results from spreading large amounts of animal wastes on cropland for the purpose of waste disposal rather than for improving soil conditions or crop growth and quality. A recent study showed that substantial quantities of nitrate accumulated when manure was applied to land at rates of 30 tons/acre or greater. Salt accumulation was also high enough to cause some injury to plant growth. Leaching can reduce the salt concentration, but may increase nitrate pollution of the drainage water. Indications are that pollution hazards are eliminated only when the growing crop utilizes most of the applied nitrogen. When the rate of manure application is too high, nitrate will accumulate in the soil and in some crops or will move through the soil with percolating water. (East Central)

W74-00399

#### EXCRETION STUDIES IN SWINE FED ARSANILIC ACID,

Abbott Laboratories, North Chicago, Ill. Nutrition Research Dept.

L. R. Overby, and D. V. Frost.

Journal of Animal Science, Vol 19, No 1, p 140-144, January, 1960, 2 tab, 9 ref.

Descriptors: \*Arsenic, \*Farm wastes, \*Swine, \*Diets, \*Feeding, Poultry.

Identifiers: \*Arsanilic acid.

The rates of arsenic excretion were determined in the feces and urine of swine receiving arsanilic acid at 30, 60 and 90 gm. per ton of feed. Much more arsenic was excreted in the feces than in the urine. After 10 days of arsanilic acid feeding, total excretion was in approximate balance with intake at the two lower levels of feeding. After the arsenical was withdrawn from the ration, the characteristic excretion level continued for two days, then decreased rapidly. This conforms with knowledge of the rate of disappearance of arsenic from tissues of animals fed arsanilic acid. The nature of the major part of the arsenical excreted was not determined. Unchanged arsanilic acid was not detected in the urine, but was present in the feces in an amount representing about 5% of the arsanilic acid consumed. (East Central)

W74-00400

#### NITROGEN COMPOUNDS IN NATURAL WATER—A REVIEW,

Geological Survey, Menlo Park, Calif.

J. H. Feth.

Water Resources Research, Vol 2, No 1, p 41-58, 1st Quarter, 1966. 1 fig, 9 tab, 57 ref.

Descriptors: \*Reviews, \*Nitrogen, Water, \*Farm wastes, Groundwater, Public health, Fixation,

\*Nitrogen cycle, \*Water pollution, Air pollution, Soil contamination, Fertilizers, Proteins, Rocks, Leaching, Precipitation, Atmosphere, Ammonia, Aerosols, Water quality, Geochemistry.

Nitrogen compounds in natural water are significant in public health, agriculture, industry, and geochemistry. The many sources of nitrogen compounds and the deep involvement of nitrogen in the life processes of organisms makes the study of such compounds difficult. The sources include natural aerosols, precipitation, fixation by microorganisms in soil and water, decaying organic matter, and animal and industrial wastes, as well as probably undiscovered sources in consolidated and unconsolidated rocks. Nitrogen compounds are both oxidized and reduced by organisms. Some nitrogen compounds are adsorbed on clay. The theoretical end product in water and the compound probably most often determined is NO<sub>2</sub>-I. The concentration of nitrogen compounds ranges from 0.0 to > 100 ppm in surface water and from 0.0 to > 1000 ppm in groundwater. Seasonal fluctuations occur. Much further research is needed, including improvements in methods of analysis, further investigation of sources, and

detailed study of the nitrogen cycle in small drainage basins. (East Central)

W74-00402

#### OBSERVATIONS ON THE EFFECT OF PROTEIN INTAKE AND STAGE OF GESTATION ON THE PROPORTION OF URINARY NITROGEN EXCRETED AS UREA IN SHEEP,

Rowett Research Inst., Bucksburn (Scotland).

J. J. Robinson, D. Scott, and C. Fraser.

Journal of Agricultural Science, Vol 80, No 3, p 363-368, June 1973. 3 tab, 4 fig, 14 ref.

Descriptors: \*Sheep, Diets, Energy.

Identifiers: \*Protein intake, \*Gestation, \*Urinary nitrogen, \*Nitrogen retention.

The effect of altering the level of protein intake on urea excretion in ewes was assessed in two separate experiments. In Experiment 1, 14 pregnant (during the last 20 days of gestation) and 10 non-pregnant ewes were each offered a different level of digested N intake in the range 5-25 g/day. At all levels of protein intake urea N excretion was lower in pregnant than in non-pregnant ewes. In Experiment 2, 21 pregnant ewe lambs were each offered one of three diets supplying mean intakes of 83 (T 1), 113 (T 2) or 147 (T 3) g crude protein/day. During the last 100 days of gestation the mean levels of urea N excretion were 6.9, 11.0 and 15.2 g/day for T 1, T 2 and T 3, respectively. The corresponding values for urinary N excretion were 9.3, 13.8 and 18.2 g/day. At all levels of protein intake urea N excretion was lower just prior to parturition than 95 days prepartum; the difference was correlated with lamb birth weight and maternal body-weight change. A notable feature of both experiments was the low level of urea N excretion by the pregnant ewes in late gestation, at low protein intakes. It would appear that when energy intake is adequate the decrease in urea N excretion associated with pregnancy is a direct result of an increased N requirement for maternal and/or foetal growth. (East Central)

W74-00408

#### ENRICHMENT OF THE ATMOSPHERE WITH NITROGEN COMPOUNDS VOLATILIZED FROM A LARGE DAIRY AREA,

Agricultural Research Service, Riverside, Calif.

R. E. Luebs, K. R. Davis, and A. E. Laag.

Journal of Environmental Quality, Vol 2, No 1, p 137-141, January-March 1973. 3 fig, 3 tab, 18 ref.

Descriptors: \*Dairy industry, \*Cattle, \*Nitrogen, Ammonia, \*Air pollution, Feed lots, \*Water pollution, Toxicity, \*Farm wastes, Sampling, Temperature, Humidity, Winds, Rainfall.

Identifiers: Distillable nitrogen, Nondistillable nitrogen, Atmospheric NH<sub>3</sub>, Enrichment.

A dairy cow population of 143,000 in an area of 150 km<sup>2</sup> enriched the atmosphere with distillable N (mostly NH<sub>3</sub>) over an area in excess of 560 km<sup>2</sup>. Over an area of 35 km<sup>2</sup>, where cow population density was approximately 1,600 cows/km<sup>2</sup>, the concentration of distillable N in the atmosphere was between 20 to 30 times greater than at a control site outside the dairy area. Highest concentrations of N were associated with wet corral surfaces and favorable evaporative conditions. Approximately 20% of the total N absorbed by acid-surface traps in the dairy area was nondistillable N while filtered air samples contained 5% or less. Rainfall delivered three times as much N to the land surface inside than outside the dairy area. (East Central)

W74-00409

#### NITRATE CONTENT OF PERCOLATES FROM MANURED LYSIMETERS,

Guelph Univ. (Ontario). Dept. of Land Resource Science.

D. G. Bielby, M. H. Miller, and L. R. Webber.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Sources of Pollution—Group 58

Journal of Soil and Water Conservation, Vol 28, No 3, p 124-126, May-June, 1973, 4 tab, 3 ref.

Descriptors: \*Nitrates, \*Farm wastes, \*Lysimeters, \*Corn, Slurries, \*Waste disposal, Groundwater, Soils, \*Poultry, Irrigation, Denitrification, Ontario.

Identifiers: \*Percolates, Guelph sandy loam.

The quantity and concentration of nitrates in percolates from lysimeters receiving liquid poultry manure applications were determined over a 3-year period. Nitrogen removed by corn, plus that in percolates, accounted for less than 25 percent of the amount applied to the soil. Most nitrates in the percolates were discharged from the lysimeters after corn harvest. The average concentration of nitrates in percolates from all treatments and for all years exceeded 10 parts per million. (East Central)  
W74-00417

**THE EFFECT OF RATION ON ENGINEERING PROPERTIES OF BEEF CATTLE MANURE,** Nebraska State Dept. of Environmental Control, Lincoln. Solid Waste Div.

G. A. Frecks, and C. B. Gilbertson.

Paper no. 73-442 presented at the 1973 Annual Meeting, American Society of Agricultural Engineers, University of Kentucky, Lexington, June 17-20, 1973. 24 p, 6 tab, 6 fig, 20 ref.

Descriptors: \*Cattle, \*Farm wastes, Kentucky, \*Feeds, \*Digestion, Volatility, Shrinkage, Porosity, Chemical properties, Physical properties, Volumetric analysis, Sieve analysis, Density, \*Waste treatment, \*Waste storage, Solids, Moisture content, Chemical oxygen demand, Engineering.

Identifiers: \*Ration, Drying rates.

Beef cattle were fed a high concentrate ration (HCR) and a high roughage ration (HRR) for five days. Samples of feces and urine were collected and analyzed to assist in the engineering design of materials handling and processing equipment and storage facilities. The total, volatile, and fixed solids content were not affected by the ration. Of the HCR wastes, 20% was retained on a 2 mm. sieve as compared to 2% for the HRR wastes. Volume change from original moisture contents to dry solids was 55% for the HCR and 74% for the HRR feces. Due to its more porous structure the HRR feces dried at twice the rate of the HCR. (Frantz-East Central)  
W74-00420

**CROP YIELDS FROM LAND RECEIVING LARGE MANURE APPLICATIONS,** Texas A and M Univ., College Station.

For primary bibliographic entry see Field 03C.

W74-00425

**AGRICULTURE AND ENVIRONMENT,** W. H. Garman.

Crops and Soils, Vol 25, No 9, p 14-19, Aug-Sept, 1973.

Descriptors: Photosynthesis, \*Water pollution, \*Nitrates, Phosphates, Soils, Eutrophication, \*Livestock, Agriculture, \*Farm wastes, Farm animals, \*Fertilizers, Feed lots, Algae, Plankton, Nutrients, Carbon dioxide, Wells, Lakes, Balance of nature.

Questions regarding agriculture and the balance of nature are answered. The use of nitrogen fertilizers can under some circumstances be harmful to farm animals, but has never presented a human health problem. Farming and nitrate fertilizers seldom, except under extreme circumstances, contribute to nitrate levels in streams, lakes, and water wells. Fertilizers seldom cause excessive algae growth. Long term experiments show that

fertilizer use has not damaged soils. (Frantz-East Central)  
W74-00427

**A MULTIPARAMETER OIL POLLUTION SOURCE IDENTIFICATION SYSTEM,** Phillips Petroleum Co., Bartlesville, Okla. Research and Development Dept.

For primary bibliographic entry see Field 05A.  
W74-00432

**BACTERIAL FLAGELLAR UNCOORDINATION AS A MONITOR FOR INDUSTRIAL POLLUTANTS,** Virginia Polytechnic Inst. and State Univ., Blacksburg, Dept. of Biology. N. R. Krieg. Completion Report, WRRC Project No. 2003240 1973. 10 p, 1 fig, 2 tab.

Descriptors: \*Bioindicators, \*Monitoring, Bacteria, Industrial wastes, Pollutant identification, Toxins, \*Path of pollutants, Ions, Zinc, Nickel, Copper, Mercury, Lead.

Identifiers: \*Spirillum volutans, \*Flagellar uncoordination.

A rapid, simple, and relatively inexpensive standardized method has been developed for the in-plant biological monitoring of levels of toxicants in industrial effluent using flagellar uncoordination in *Spirillum volutans* as the indicator response. Zinc, nickel, copper, mercury, and lead ions could be detected at concentrations of 2 or 3 ppm; cetyl pyridinium chloride at 1 ppm; aniline at 30 ppm; and other compounds in a similar concentration range. Combinations of metals were detected when each was present at a level lower than its minimum effective concentration when used alone. The response, which is visible immediately by darkfield microscopy at 125X, is a marked and obvious change in the motility of the organism. Normal cells reverse frequently because the polar fascicles of flagella reorient, forming 'head' and 'tail' cones of rotation which propel the cell through the medium. Various compounds cause the flagella to become uncoordinated, forming two 'head' or two 'tail' fascicles on the same cell, which is then unable to swim because of opposing propulsion. The method was developed for use in testing samples of effluent for uncoordinating concentrations of toxic agents before discharge into a receiving stream.  
W74-00438

**SULPHUR POLLUTION PATTERNS OBSERVED: LEACHING OF CALCIUM IN FOREST SOIL DETERMINED,** Norske Skogforsoksvæsen, Oslo. L. N. Overrein.

Ambio, Vol 1, No 4, p 145-147. 1972. Illus. Identifiers: \*Calcium, Forest soils, Iron, \*Leaching, Magnesium, \*Norway, Pollution sources, Potassium, Precipitation, Sodium, Soils, \*Sulfur.

Two aspects of S pollution are presented. The deposition pattern around a Norwegian industrial center was mapped and experiments were conducted to determine the effect of varying acidity precipitation on the Ca levels of forest soils. To chart the deposition pattern, pollution gradients were obtained from snow samples taken around Heroya, an industrial center in southern Norway. The measurements indicated that rural districts, 15-40 km outside the main source of pollution, received the greatest amounts of excess acid in precipitation. The largest deposits of Ca, Mg, Fe, Mn, K, Na and sulfate were confined to the urban district near the source of pollution. The leaching of Ca in different soil types increases drastically when the acidity of the precipitation is increased. The acidity of the soil was determined primarily by 4 factors: the concentration of excess acid in

precipitation; the amount of acid water penetrating the soil profile; the susceptibility to leaching of the nutrient elements available; and, the buffer capacity of the soil. The gradual acidification of the soil is accompanied by increasing acidity in the groundwater. An increasingly acid precipitation represents an environmental stress in areas where the soil is susceptible to excess acid and leaching and there might be serious consequences for the various ecosystems established in those areas. Copyright 1973, Biological Abstracts, Inc.  
W74-00476

**DYNAMICS OF TRACE ELEMENTS IN LIMAN-MEADOW SOILS OF THE ARID ZONE OF CENTRAL KAZAKHSTAN, (IN RUSSIAN),** Akademii Nauk Kazakhskoi SSR, Alma-Ata. Institut Pochvovedeniya. V. A. Zhukova, and E. A. Solodnikova.

Izv Akad Nauk Kaz SSR Ser Biol. 1. p 6-11. 1972. Identifiers: Arid zones, Boron, Cobalt, Copper, Irrigation, Manganese, Molybdenum, \*Soils (Liman-meadow), \*Trace elements, \*USSR (Kazakhstan), Zinc.

Cu, Zn, Mn, Co, Mo and B were studied at various depths in soil of Central Kazakhstan (USSR). Irrigation was the main factor in formation of hydromorphic soils. These soils are formed under leaching and oozing water regimes. The upper layers during some seasons of the year contain highly active forms of Cu, B, average and low forms of Co, low and very low forms of Zn and Mo. The mechanical composition of the soil is an important factor in the quantity of active Mn. Provision of Mn in clayey soils is high, in loamy soils Mn varies from low (in spring-summer) to high (late summer, early fall) levels. With depth, the content of active forms of Cu, Mn and Co decrease, while Zn, B and Mo increase in liman-meadow soils. Copyright 1973, Biological Abstracts, Inc.  
W74-00479

**DESMIDIACEAE OF WASTE WATERS, (IN RUSSIAN),** Kharkov State Univ. (USSR). For primary bibliographic entry see Field 05D.

W74-00485

**RESEARCH ON THE METTMA BROOK AT FALKAU, (IN GERMAN),** Freiburg Univ. (West Germany). Limnologisches Institut.

J. Schwoerbel. Arch Hydrobiol Supplement B. Vol 42, No 1, p 91-94. 1972. Illus. (English summary). Identifiers: \*Germany (Mettma stream), Pollution sources, \*Brewery waste water.

Between May 1970 and May 1971, the running water research staff of the Limnological Institute of the University of Freiburg (Germany) examined the bioactivity of the mountain brook Mettma (Germany), which lies in the south of the Black Forest and is polluted by a brewery's waste water. A short introduction is presented to the results described in later papers. Copyright 1973, Biological Abstracts, Inc.  
W74-00497

**THE METTMA: A MOUNTAIN STREAM AS A BREWERY'S DRAINING DITCH: MICROBIOLOGICAL INVESTIGATIONS ALONG THE GRADIENT OF POLLUTION, (IN GERMAN),** Freiburg Univ. (West Germany). Limnologisches Institut.

W. Reichardt, and M. Simon. Arch Hydrobiol Supplement B. Vol 42, No 1, p 125-138. 1972. Illus. (English summary). Identifiers: Bacteria, \*Brewery wastes, Draining ditches, Enzymes, \*Germany (Mettma stream),

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources of Pollution

Microbiological studies, Mountain streams, \*Pollution gradient, Streams, \*Self purification.

A small mountain stream (Mettma, in Germany) is polluted by waste water from a brewery. The process of self-purification was investigated. The number of heterotrophic bacteria and the biochemical activities of maltase, alkaline phosphatase, dehydrogenase, nitrate reductase and cellulase, mostly in both the water and in the sediment, were investigated.—Copyright 1973, Biological Abstracts, Inc. (See also W74-00497) W74-00498

**HYDROGRAPHY, CHEMISTRY AND LOAD OF NUTRIENTS OF A MOUNTAIN STREAM POLLUTED BY ORGANIC WASTE WATER, (IN GERMAN),**  
Freiburg Univ. (West Germany). Limnologisches Institut.  
For primary bibliographic entry see Field 05C.  
W74-00499

**POLLUTION ENDANGERED UNDERGROUND WATERS IN THE NEIGHBOURHOOD OF A SEWAGE CATCHPIT DESIGNED ON THE MORAINA HIGHLAND OF NORTHERN POLAND,**  
Academy of Mining and Metallurgy, Krakow (Poland). Inst. of Hydrogeology and Engineering Geology.

A. S. Kleczkowski, J. Myszka, and J. Stobierski. Bull Acad Pol Sci Ser Sci Terre. Vol 20, No 1, p 61-64. 1972.

Identifiers: Moraine highlands, \*Poland, Pollution, \*Sewage catchpit, Underground waters, Clay, Sands.

The sewage catchpit is located on permeable quaternary sands. Its bottom lies almost directly above the water table; it might even cut through it. The downflow of ground waters and impurities will run toward the river flowing at a distance of 500 m. The thin water-bearing horizon above the moraine is thus directly endangered. There is no natural protection of the moraine horizon (up to 20 m thickness). The efficient intermoraine horizon, protected by a continuous boulder clay layer of more than 2 m, is secure.—Copyright 1973, Biological Abstracts, Inc.  
W74-00500

**TIDAL CHARACTERISTICS OF TWO ESTUARIES IN FLORIDA,**  
W. B. Stelzenmuller.

Journal of the Waterways and Harbors Division, American Society of Civil Engineers, Vol 91, No WW3, Proceedings Paper 4431, p 25-36, August 1965. 10 fig, 2 ref.

Descriptors: \*Estuaries, \*Tidal effects, Water pollution, Sea level, Wind tides, Winds, Hurricanes, Storms, \*Tidal streams, \*Saline water intrusion, Runoff, Salt marshes, \*Florida, Path of pollutants, \*Gulf coastal plain.

Identifiers: Estuarine processes, \*Estuarine pollution, Waccasassa River (Fla), Fenholloway River (Fla).

A study of tidal characteristics of the Waccasassa River and the Fenholloway River estuaries in the Gulf of Mexico (Florida) are reported. Results of a 2-year study are presented. Information is given on the influence of wind on tides and annual variations of sea level. Both estuaries have an exponential increase of cross-section with downstream distance and are in the category of partly-mixed estuaries. The influence of hurricanes is included. The two estuaries under study are physically similar in size, pattern of tidal action, low and marshy coastal segments with many interconnecting channels to adjacent creeks, rocky bottoms, and the extremely shallow coastal shelf into which they both empty. These similarities make the study

of a virtually pristine tidal stream and a grossly polluted one especially worthwhile. The differences are principally the relatively steeper slope of the Fenholloway, which tends to reduce the diffusing action of salt water intrusion into the estuary, and the embayment of the Waccasassa, which is not duplicated at the Fenholloway. Wind effects on tidal heights and tidal mixing are especially important in the shallow waters of this section of the coast. The annual pattern of variation of sea level is also to be considered in evaluating the behavior of the estuaries in ridding themselves of pollution. Higher sea levels tend to coincide with higher run-off seasons and lower sea levels with lower run-off seasons along this coast. (Sinh-OEIS)  
W74-00508

**TWO STUDIES OF PESTICIDE RESIDUES,**  
Texas A and M Univ., College Station. Environmental Quality Program.  
For primary bibliographic entry see Field 05C.  
W74-00529

**A STUDY OF PESTICIDE RESIDUE LEVELS AND INSECTICIDE RESISTANCE IN SELECTED AQUATIC ORGANISMS OCCURRING AROUND THE BRYAN-COLLEGE STATION AGRICULTURAL PRODUCTION AREAS,**  
Texas A and M Univ., College Station. Environmental Quality Program.

For primary bibliographic entry see Field 05C.  
W74-00530

**A SURVEY OF DDT RESIDUES IN FISH FROM THE BRAZOS AND NAVASOTA RIVERS AND SOMERVILLE RESERVOIR,**  
Texas A and M Univ., College Station. Environmental Quality Programs.  
For primary bibliographic entry see Field 05C.  
W74-00531

**UNDERGROUND MOVEMENT OF WASTES CLARIFIED.**

Chemical and Engineering News, p 15, October 15, 1973.

Descriptors: \*Water pollution sources, \*Ground-water movement, \*Nuclear wastes, \*Nuclear reactors, \*Idaho, Path of pollutants, Tracers, Tritium, Model studies, Data collections, Correlation analysis, Mathematical models, Chlorides, Analytical techniques, Hydrogeology, Water analysis.  
Identifiers: \*National Reactor Testing Station (Idaho).

Studies of the movement of radioactive materials and common inorganic chemicals at the National Reactor Testing Station in Idaho have led to development of a mathematical model which aids understanding of the Snake River Plain aquifer both hydrologically and chemically. Moreover, modeling techniques based on the results of these studies might be used in other large-scale problems of waste and water-resources management. Since 1952, just after the first reactor started up, an average of 200 million gallons a year of low-level radioactive wastes have gone to ponds. About 70% of the various activation and fission products are short-lived and of little significance. Of the others, only tritium has entered the Snake River Plain aquifer in detectable amounts. Tritium makes a very good tracer because it is unaffected by ion exchange or other interfering reactions. The mathematical model of waste transport developed by USGS at NRTS involves two main phases—hydrology and solute transport. The model-simulated chloride distributions match well with historical observations. The tritium distribution also is excellent. Forecasts for the various plumes show gradual growth and more dilution. (Woodard-USGS)  
W74-00538

**CIESM AND MARINE POLLUTION,**  
Office of Naval Research, London (England).  
J. M. Leonard.

Available from NTIS, Springfield, Va. 22151 as AD-757 988; Price \$3.00 printed copy; \$1.45 microfiche. Report C-5-73, February 5, 1973. 11 p.

Descriptors: \*Water pollution sources, \*Water pollution control, \*Oceans, \*Conferences, \*Foreign countries, Effluents, Liquid wastes, Sewage effluents, Industrial wastes, Municipal wastes, Oil spills, Water sampling, Data collections, Chemical analysis, Heavy metals, Pesticides, Nutrients, Reviews.  
Identifiers: \*Mediterranean Sea, Symposium.

**La Commission Internationale pour l'Exploration Scientifique de la mer Méditerranée (CIESM)** was founded in 1910 by Prince Rainier I, of Monaco. The current president is the present Prince of Monaco, Rainier III. A 2-day session on Marine Pollution preceded the Plenary Congress of CIESM, held in Athens in November 1972. About 40 papers dealing with various aspects of pollution in the Mediterranean were given. Presentations are listed and those which seemed particularly interesting are discussed. A mildly optimistic prognosis is given for pollution research in the Mediterranean. (Woodard-USGS)  
W74-00543

**SUMMARY OF CHEMICAL AND RADIOCHEMICAL MONITORING OF WATER FOR THE CANNIKIN EVENT, AMCHITKA ISLAND, ALASKA, FISCAL YEAR 1972,**  
Geological Survey, Lakewood, Colo.  
L. J. Schroder, and W. C. Ballance.

Available from NTIS, Springfield, Va. 22151 USGS-474-167 Price \$4.00 printed copy; \$1.45 microfiche. Contract Report USGS-474-167, 1973. 39 p, 5 fig, 6 tab, 8 ref. AEC Contract AT (49-16)-3002.

Descriptors: \*Nuclear explosion, \*Underground, \*Alaska, \*Water analysis, \*Pollutant identification, Chemical analysis, Tritium, Nuclear meters, Radioactivity, Dissolved solids, Sampling, Correlation analysis, Data collections, Radiochemical analysis.  
Identifiers: \*Amchitka Island (Alaska), Cannikin event, Gross beta/gamma activity.

Amchitka Island, Alaska, was the site for three underground nuclear detonations. The Long Shot event was conducted on October 29, 1965, the Milrow event on October 2, 1969, and the Cannikin event on November 6, 1971. This report is concerned with the Cannikin event. An increased dissolved-solids content was found immediately after the Cannikin event at most of 10 locations in a water-sampling network established in 1967 and revised in September 1971. The observed dissolved-solids content increase was within the seasonal range that has been observed at these locations. No measurable increase in radioactivity was detected as a result of the Cannikin event at the 72 locations monitored during fiscal year 1972. A measurable increase in gross beta/gamma activity was found in January 1972 which was correlated to a surface test of a nuclear device by a foreign nation. (Woodard-USGS)  
W74-00547

### 5C. Effects of Pollution

**TRITIUM PRODUCTION.**  
For primary bibliographic entry see Field 05B.  
W74-00009

**KINETICS OF TRITIUM IN BIOLOGICAL SYSTEMS.**  
For primary bibliographic entry see Field 05B.  
W74-00011

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Effects of Pollution—Group 5C

#### CERTAIN ENVIRONMENTAL ASPECTS OF TRITIUM. For primary bibliographic entry see Field 05B. W74-00012

#### LAND RECLAMATION AND RIVER POLLUTION PROBLEMS IN THE CROAL VALLEY CAUSED BY WASTE FROM CHROMATE MANUFACTURE, Liverpool Univ. (England). Dept. of Botany.

V. G. Breeze.  
Journal of Applied Ecology, Vol 10, No 2, p 513-525, August 1973. 1 fig, 8 tab, 20 ref.

Descriptors: \*Toxicity, \*Chromium, \*Industrial wastes, Surface runoff, \*Aquatic plants, \*Land reclamation, \*Leaching, Heavy metals, Water pollution effects, Algae, Plants, Chromates, Soils, Chrysophyta.

Identifiers: *Gomphonema parvulum*, *Navicula cryptocephala*, *Navicula viridula*, *Navicula radiosus*, *Navicula cincta*, *Navicula rhynchocephala*, *Achnanthes minutissima*, *Elodea canadensis*, \*United Kingdom (Croal River).

Wastes resulting from chromate manufacture have had toxic effects on the disposal area, and runoff from the waste have had severe effects on river flora. Toxicity studies were conducted with plants grown on the waste overlayed with soil. Composition of soluble portions of the waste was determined by progressively dissolving the material in increasing amounts of acid. An indication of the composition could be obtained from the elements which appeared in solution. Toxicity was also studied with seeds placed in Petri dishes containing solutions of chromic sulfate or potassium dichromate dissolved in water and with soil samples treated with the chemicals. The waste was toxic to plants even when diluted seven times with soil. Layers of soil over the waste are only successful if deep, due to upward diffusion of highly toxic chromate ions. Chromic ions in soil are much less toxic as chromic hydroxide and organic complexes are formed (and not because chromate is more toxic as has previously been reported). This suggests that reclamation could be achieved by chemically reducing the chromate in the waste. The waste causes serious river pollution due to leaching of chromate, but successful reclamation would lessen this. Chemical reduction of the chromate entering the river could also be beneficial as chromic ions are more rapidly lost from solution in river water. (Little-Battelle)

W74-00045

#### EFFECTS OF ARTIFICIAL AERATION ON THE CHEMISTRY AND ALGAE OF TWO MICHIGAN LAKES, Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.

A. W. Fast, B. Moss, and R. G. Wetzel.  
Water Resources Research, Vol 9, No 3, p 624-647, June 1973. 1 fig, 28 ref.

Descriptors: \*Primary productivity, Water chemistry, \*Aquatic algae, \*Environmental effects, Water properties, Mixing, Nutrients, Phytoplankton, Periphyton, Water analysis, Thermal stratification, Desratification, \*Aeration, Water sampling, Dissolved oxygen, Carbon dioxide, Alkalinity, Conductivity, Calcium, Magnesium, Potassium, Sodium, Phosphorus, Nitrogen, Mercury, Chemical analysis, Aquatic soils, Hypolimnion, Standing crops, Alkali metals, Alkaline earth metals, \*Michigan, Chemical properties, Physical properties, Epilimnion, Lake sediments.

Identifiers: Artificial aeration, \*Section Four Lake (Mich), \*Hemlock Lake (Mich), Organic carbon, Particulate organic carbon, Dissolved organic carbon, Total organic carbon.

In order to determine the effect of artificial aeration in lakes, an unproductive hard water lake (Section Four Lake) and an eutrophic lake (Hem-

lock Lake) were artificially aerated using compressed air. Section Four Lake was completely mixed whereas Hemlock Lake had its hypolimnion aerated but thermal stratification maintained. Water samples were collected with a PVC Van Dorn sampler and determinations were made for dissolved oxygen, carbon dioxide, pH, total alkalinity, conductivity, total dissolved organic carbon, total particulate organic carbon, Ca, Mg, K, and Na. Total carbon content of the sediment was also measured. Foam samples were analyzed for total P, N, and Hg. Primary productivity estimates were made, and phytoplankton and periphyton samples were analyzed. Chemical and algal changes in Section Four Lake during desratification were not great. Although phytoplankton production potentials increased during mixing, the phytoplankton standing crop appeared to decline slightly, possibly due to the increased mixing depth and turbidity. Hemlock Lake hypolimnetic anoxia and conditions associated with it were eliminated during aeration. The lake gradually desratified during aeration due to leaks in the aeration tower. These leaks also released nutrient rich water into the epilimnion, which promoted algal growth. (Holoman-Battelle)

W74-00048

#### PHOTODECOMPOSITION OF THE HERBICIDE METHAZOLE, Kentucky Univ., Lexington. Dept. of Entomology. For primary bibliographic entry see Field 05B. W74-00050

#### POLYCHLORINATED TERPHENYLS IN THE ENVIRONMENT.

Rijksinstituut voor de Volksgezondheid, Utrecht (Netherlands). Lab. of Toxicology.

For primary bibliographic entry see Field 05A.  
W74-00057

#### A SIMPLIFIED CLEAN-UP TECHNIQUE FOR ORGANOCHLORINE RESIDUES AT THE MICROLITER LEVEL,

Lund Univ. (Sweden). Dept. of Animal Ecology.  
For primary bibliographic entry see Field 05A.  
W74-00058

#### GAS CHROMATOGRAPHIC PROCEDURE TO ANALYZE AMINO ACIDS IN LAKE WATERS, Wisconsin Univ., Madison. Water Chemistry Program.

For primary bibliographic entry see Field 05A.  
W74-00061

#### A REVIEW OF OUTBOARD MOTOR EFFECTS ON THE AQUATIC ENVIRONMENT, Massachusetts Univ., Amherst. Dept. of Civil Engineering.

T. P. Jackiwicz, Jr., and L. N. Kuzminki.  
Journal Water Pollution Control Federation, Vol 45, No 8, p 1759-1770, August 1973. 2 fig, 6 tab, 30 ref.

Descriptors: Aquatic environment, \*Water pollution sources, \*Water pollution effects, \*Reviews, Pollutants, Boats, Organic compounds, Lead, Phenols, Water pollution, Water quality, Oil, Boating, Biochemical oxygen demand, Chemical oxygen demand, Heavy metals.

Identifiers: \*Watercraft, Two-stroke outboard motors, Engine exhausts, Crankcase drainage, Exhaust emissions, Motor fuel, \*Outboard motors, Operation efficiency.

Various aspects of outboard motor operation, including the magnitude of watercraft usage, operation and efficiency of a two-cycle engine, composition of outboard motor fuels, and compounds emitted during operation are reviewed. Compounds emitted to receiving waters originate from drainage of crankcase liquids and from unburned

fuel passing through the combustion chamber. Over half the original fuel mixture for outboard motors may be emitted unburned into receiving waters. Factors affecting the quantity of compounds exhausted from outboard motors include horsepower rating, crankcase size, composition of fuel mixture, tuning of the engine, and speed of operation. Some of the compounds measured in water contaminated by motor exhaust include volatile and nonvolatile oil, lead and phenols. (Holoman-Battelle)

W74-00063

#### SOME CONSIDERATIONS OF THE CHEMICAL LIMNOLOGY OF MEROMICTIC LAKE MARY, Wisconsin Univ., Madison. Water Chemistry Program.

W. C. Weimer, and G. F. Lee.

Limnology and Oceanography, Vol 18, No 3, p 414-425, May 1973. 3 fig, 4 tab, 30 ref.

Descriptors: \*Meromixis, Water analysis, Water pollution effects, Trophic level, Water quality, Water sampling, Water chemistry, Water temperature, Dissolved oxygen, Turbidity, Color, Hydrogen ion concentration, Specific conductivity, Alkalinity, Sulfides, Methane, Chlorides, Sodium, Potassium, Calcium, Magnesium, Sulfates, Iron, Dissolved solids, Suspended solids, Chemical oxygen demand, Ammonia, Nitrates, Nitrates, Phosphates, Hydrogen sulfide, Nutrients, \*Wisconsin, Sampling, Colorimetry.

Identifiers: \*Lake Mary (Wis.), Characterization, \*Chemical limnology, Chemical composition, Lake Rose, Orthophosphates, Sample preservation, Sample preparation, Atomic absorption spectrophotometry.

Meromictic Lake Mary was studied and compared with dimictic Lake Rose to evaluate the relative roles of several chemical species to determine the species of primary importance in promoting or maintaining meromixis. The approach involved detailed analyses of the dominant ionic species in the distinct layers of the lakes. Analyses included: temperature, DO, transparency, true color, pH, specific conductance, alkalinity, sulfide, methane, chloride, Na, K, Ca, Mg, sulfate, Fe, dissolved and suspended solids, COD, ammonia, nitrate, nitrite, phosphate, orthophosphate, and hydrogen sulfide. Both lakes exhibited similar seasonal variations in their chemical composition. The chemical composition of the monimolimnetic waters of Lake Mary did not vary throughout the 21-month study. Methane production in Lake Rose began soon after thermal stratification and concentrations in the anoxic hypolimnion reached about 14 mg/liter. Methane concentrations in the Lake Mary monimolimnion increased with depth and ranged up to 21 mg/liter. The concentration and vertical distribution of CH<sub>4</sub>, together with an alkalinity increase of 22 mg/liter above that in the surface waters and an NH<sub>4</sub> (plus) increase of 4.2 mg/liter, indicated that biological activity helps sustain the meromixis of Lake Mary. However, the major factor allowing meromixis is the morphometry of the lake basin. (Little-Battelle)

W74-00064

#### NUTRIENT FACTORS LIMITING PRIMARY PRODUCTIVITY IN SIMULATED AND FIELD ANTARCTIC MICROECOSYSTEMS, Virginia Commonwealth Univ., Richmond. Dept. of Biology.

G. L. Samsel, Jr., and B. C. Parker.

Va J Sci. Vol 23, No 2, p 64-71, 1972. Illus.

Identifiers: Ammonia, \*Antarctic, Carbon-14, Chlorides, Ecosystems, Ecosystems, Iron, Nitrates, \*Nutrients, Phosphates, \*Primary productivity, Silicates.

Compared both in laboratory microecosystems and under natural field conditions, were the effects of selected nutrient enrichments on the algal communities of 2 closely associated Antarctic

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lakes to discover which inorganic nutrients might most likely be responsible for the observed 'trophic' differences between them. Laboratory aquatic microecosystems simulating both lakes were established in several types of containers with living microbial communities from both lakes. Effects of enrichments with ammonia, phosphate, nitrate, silicate, Fe, and chloride singly and in combinations were examined periodically for 30-40 days, by evaluating photosynthetic  $^{14}\text{C}$  uptake rates by phytoplankton. Ammonia was the principal nutrient causing the differences in primary productivity. Phosphate also induced a small but significant stimulation of primary productivity, especially in combination with ammonia. Other enrichments were ineffective. Field enrichment studies, although conducted during a second season, essentially confirm laboratory results.—Copyright 1973, Biological Abstracts, Inc.  
W74-00069

**SEASONAL VARIATIONS IN SELECTED PHYSICOCHEMICAL CONDITIONS OF A SMALL LAKE IN BRAZOS COUNTY, TEXAS, TEXAS Water Quality Board, Austin.**  
For primary bibliographic entry see Field 02H.  
W74-00074

**QUALITATIVE AND QUANTITATIVE VARIATION OF NET PLANKTON OF CRAIGHEAD LAKE, Oklahoma State Univ., Stillwater. Dept. of Entomology.**  
For primary bibliographic entry see Field 02H.  
W74-00075

**CHANGES IN FAUNA OF WATER MITES (HYDRACARINA) OF KIERSKIE LAKE, (IN POLISH),**  
Polish Academy of Sciences, Poznan. Inst. of Zoology.  
E. Biesiada.  
Pol Pismo Entomol. Vol 42, No 2, p 263-271, 1972.  
English summary.  
Identifiers: \*Eutrophication, Fauna, Hydracarina, Lakes, \*Poland (Kierskie Lake), \*Water mites.

The water mite fauna of Kierskie Lake (near Poznan, Poland) is compared with the one investigated by Tutaj (1936) about 40 yr ago. There were 36 spp. and spp. not recorded by Tutaj. The occurrence of 12 spp. of the 27 found in this lake by Tutaj was not confirmed. There were considerable differences in the abundance of particular species. These changes may be related to progressive eutrophication of the Kierskie Lake and its growing sport and tourist exploitation.—Copyright 1973, Biological Abstracts, Inc.  
W74-00078

**METHYLMERCURY AS PERCENTAGE OF TOTAL MERCURY IN FLESH AND VISCERA OF SALMON AND SEA TROUT OF VARIOUS AGES,**  
National Swedish Food Administration, Stockholm. Food Lab. G. Westoo. Science, Vol 181, No 4099, p 567-568, August 10, 1973. 1 tab, 5 ref.

Descriptors: \*Gas chromatography, \*Neutron activation analysis, Marine fish, Atlantic salmon, Mercury, Heavy metals, Age, \*Salmon, \*Pollutant identification.  
Identifiers: \*Methylmercury, Biological samples, \*Sea trout, Tissue, Viscera, *Salmo* *salar*, *Salmo* *ocla*, Sweden.

Salmon (*Salmo* *salar*) and sea trout (*S. ocla*) of various ages were analyzed for total mercury by neutron activation analysis and for methylmercury by gas chromatography. The purpose was to determine whether the proportion of methylmercury

was related to the age of the fish. Methylmercury in salmon 1 to 7 years old and in sea trout 1 and 2 years old averaged 93 percent and was independent of age. In both species 1 and 2 years old, methylmercury constituted 26 to 27 percent of the total visceral mercury independent of age. (Little-Battelle)  
W74-00079

**METHOD FOR CONTROLLING ALGAE POLLUTION,**  
Kettering Scientific Research, Inc., Yellow Springs, Ohio. (Assignee)  
For primary bibliographic entry see Field 05G.  
W74-00088

**EFFECTS OF WATERSHED DEVELOPMENT ON WATER QUALITY,**  
Tennessee Valley Authority, Chattanooga. Water Quality Branch.

R. Ruane, and E. G. Fruh.  
Journal of American Water Works Association, Vol 65, No 5, p 358-363, May 1973. 12 fig, 4 tab, 6 ref.

Descriptors: \*Analytical techniques, \*Urban impact, \*Water quality, \*Water pollution control, Testing procedure, Evaluation, Watershed management, Urbanization, Urban drainage, Impoundments, Bacteria, Water purification, Water supply, Watersheds (Basins), Water treatment, Measurement, \*Texas.  
Identifiers: Austin (Tex).

Water treatment plants continuously measure a variety of water quality characteristics of the raw water they use. Thus, the plants are a 'water-quality monitor' for their sources of water. A review of the records for two water treatment plants on the Colorado River in Austin, Texas, is presented. One of the two plants has been in operation since 1924; the records for it show how construction of several impoundments upstream from Austin have affected water quality and also how water quality has deteriorated in recent years as a result of increased urbanization. The investigation also revealed the following: bacterial concentrations increased significantly in the river immediately following the construction of upstream impoundments; bacterial concentrations in the river are generally increasing, indicating the effects of increased population and urbanization; and the water quality in the plant serving the more urbanized area was less desirable than that in the other plant. (McKnight-Florida)  
W74-00118

**EFFECT OF RIVER DISCHARGE REGULATION ON THE LOWER DON PHYTOPLANKTON, (IN RUSSIAN),**  
Azovskii Nauchno-Issledovatel'skii Institut Rybnoho Khozyaistva, Rostov-na-Donu (USSR). E. I. Aksanova.  
Gidrobiol. Zh. Vol 8, No 3, p 34-38. 1972. Illus. (English summary).

Identifiers: Bacillariophyta, Chlorophyta, Chrysophyta, Cyanophyta, Discharge, Euglenophyta, \*Phytoplankton, \*Regulation, River, Species, \*USSR (Lower Don River).

As a result of the river discharge regulation, essential changes took place in the composition and quantitative development of phytoplankton of the Lower Don (USSR). Its taxonomic composition was enriched by new species and genera of Cyanophyta, Chrysophyta, Bacillariophyta, Euglenophyta and Chlorophyta typical of the lakes and reservoirs. Quantitative changes were expressed in a sharp increase of the quantity of all groups of algae, especially Cyanophyta. An average number of algae for the vegetative period had a 17-fold increase, Cyanophyta had a 33-fold increase. A leading role in the plankton passed from Bacillariophyta and Chlorophyta to

Cyanophyta.—Copyright 1973, Biological Abstracts, Inc.  
W74-00120

**DISTRIBUTION OF PEAT BOGS ON EARTH, THEIR TYPES AND CHARACTERISTICS, (IN RUSSIAN),**  
For primary bibliographic entry see Field 02H.  
W74-00147

**NITROGEN SOURCES AND CYCLING IN NATURAL WATERS,**  
Florida Univ., Gainesville. Dept. of Environmental Engineering.  
P. L. Brezonik.

Copy available from GPO Sup Doc as EPL23:660-73-002, \$2.35; microfiche from NTIS as PB-224 491, \$1.45. Environmental Protection Agency, Ecological Research Series, EPA-660/3-73-002, July 1973. 167 p, 42 fig, 31 tab, 190 ref. EPA Project 16010 DCK.

Descriptors: \*Eutrophication, Limnology, \*Nutrients, \*Nitrogen fixation, \*Cyanophyto, Water quality, Trophic level, Algae, Bacteria, \*Florida, Lakes, Phosphorus, \*Lake sediments, \*Nitrogen cycle, Ammonia, Organic loading, Hypolimnon.  
Identifiers: Waccassa Estuary (Fla), Acetylene reduction, Anoxic hypolimnon.

Sources of nitrogen were reviewed to determine their significance in lake nitrogen budgets. Nutrients in rainfall were evaluated and found to be significant. Nitrogen and phosphorus budgets were calculated for 55 Florida lakes and critical loading rates established by comparing calculated budgets with data on trophic state. Nitrogen fixation by Cyanophyceas was studied in detail in two eutrophic Florida lakes for one year. Also a survey of fixation in Florida lakes was conducted and fixation found only in eutrophic lakes. Bacterial fixation was found to contribute significant nitrogen to the anoxic hypolimnon of a small stratified lake. Nitrogen fixation was found in both lacustrine and estuarine sediments. Sediments of 55 lakes were characterized chemically and results suggest that such sediment may act as an ammonia buffer, sorbing ammonia at high concentrations and releasing it to ammonia depleted water. Estuarine sediment absorbed ammonia strongly but failed to release it to overlying water. The acetylene reduction assay for nitrogen fixation was evaluated. Interferences in automated nutrient determinations due to organic color were studied and simple color correction found for nitrite, nitrate and orthophosphate but not ammonia as determined by the indophenol method. Amino acids also interfered with the ammonia analysis. (EPA)  
W74-00149

**WEED HARVEST AND LAKE NUTRIENT DYNAMICS,**  
North Dakota Univ., Grand Forks. Dept. of Biology.  
J. K. Neel, S. A. Peterson, and W. L. Smith.

Copy available from GPO Sup Doc as EPL23:660-73-001, \$1.25; microfiche from NTIS as PB-224 492, \$1.45. Environmental Protection Agency, Ecological Research Series, Report EPA-660/3-73-001, July 1973. 91 p, 26 fig, 9 tab, 30 ref. EPA Project 16010 DFI.

Descriptors: \*Minnesota, \*Eutrophication, \*Nutrients, Nutrient requirements, Water pollution, Sediments, Biota, Weed control, \*Nutrient removal, \*Algal control, Diatoms, Cyanophyta, Chlorophyta, Nitrogen, Phosphorus.  
Identifiers: Pelican River (Minn), \*Weed harvester, Watershed pollution, \*Lake Salie (Minn).

After more than sixty years of cultural eutrophication, Lake Salie, Minnesota, supports dense growths of phytoplankton and rooted vegetation.

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Its major water mass has the chemical character imparted by photosynthesis at all seasons, and chemical effects of decomposition are rather localized. Phytoplankton dominance alternates among diatoms, blue-green, and green algae in that order of abundance. Prior to operation of a week harvester, attached plants grew densely over 34% of the bottom area. The bulk of nitrogen and phosphorus is usually contained in the water mass, with noticeably smaller amounts in upper bottom sediments and biota. The fish population, less than one half of the mass of weeds, contained considerable more N and P than weeds in 1971. Harvest in 1970 evidently reduced weed density in 1971, and increased the cost per unit of nutrients removed. Nitrogen and phosphorus removed in weeds were insignificant when compared with annual water borne waste effluent contributions to the lake. Cost of phosphorus removal by weed harvest was \$61 and \$199 per pound in 1970 and 1971, respectively; nitrogen cost \$8 and \$21 and carbon \$0.64 and \$1.62 per pound for the same two years. (EPA)  
W74-00150

#### RATES OF PHOTOSYNTHESIS AND PHYTOPLANKTON GROWTH IN SHAGAWA LAKE, MINNESOTA,

Minnesota Univ., Minneapolis. Limnological Research Center.

R. O. Megard.

Copy available from GPO Sup Doc as EPL 23:73-039, \$0.95; microfiche from NTIS as PB-224 462, \$1.45. Environmental Protection Agency, Ecological Research Series, Report EPA-R3-73-039, July 1973. 69 p, 10 fig, 13 tab, 42 ref. EPA Project 16010 DEG.

Descriptors: \*Phytoplankton, \*Photosynthesis, Phosphorus, Lakes, \*Eutrophication, Aquatic algae, Nutrients, Water pollution effects, \*Minnesota.

Identifiers: Lake pollution, \*Shagawa Lake (Minn), \*Aphanizomenon.

Integral photosynthetic rates and growth rates of phytoplankton were measured before, during, and after a bloom of *Aphanizomenon*, which occurred in August 1970. The size of the population increased during the bloom despite decreasing specific production rates, probably because the dominant algal became more buoyant and decreased its sinking rate. The effects of changing the specific production rates and specific loss rates are demonstrated by comparing the integral photosynthetic rates and chlorophyll concentrations that would prevail under steady state conditions. (EPA)  
W74-00151

#### EUTROPHICATION RESEARCH APPLIED TO WATER QUALITY MANAGEMENT ON THE GREAT LAKES,

Department of the Environment, Burlington (Ontario). Centre for Inland Waters.

For primary bibliographic entry see Field 10A.

W74-00205

#### PARASITES, DISEASE, AND DISEASE CONTROL OF GREAT LAKES ANADROMOUS AND COMMERCIAL FISH,

Michigan Dept. of Natural Resources, Lansing.

L. N. Allison.

Available from the National Technical Information Service as COM-72-11250, \$3.00 in paper copy, \$1.45 in microfiche. Prepared for National Marine Fisheries Service, Completion Report NOAA-72091928, December 1971. 133 p, 3 fig, 19 tab, 35 ref. AFC-7.

Descriptors: \*Fish diseases, \*Fish parasites, \*Pest control, \*Michigan, Anadromous fish, Commercial fish, Fish hatcheries, Brook trout, Brown trout, Salmon, Fungicides, Anthelmintics (Pesticides), Rainbow trout, Perches, Bacteria, Fish diets, Parasitism, Pathogenic fungi, Chinook salmon, Antibiotics (Pesticides).

Identifiers: Redworm, Yellow grub, Gill lice, Furunculosis, Tapeworms, Whirling disease, Drugs, Alewives, Gill disease, Ortho Diquat, Hyamine 1622, Dexon, Di-n-butyl tin oxide, Tylosin Lactate, Acanthocephala, Kidney disease, White spot, Pyridylmercuric acetate.

Fish diseases, fish parasites and hatchery techniques were studied at the Grayling Research Station of the Michigan Department of Conservation. A nutrition study of six commercially made pellets was made on rainbow trout fingerlings. Several commercial trout diets were compared and determination made of those giving superior results in Michigan hatcheries. Material was compiled into a guideline for regulating and controlling importation of fish and eggs into the state. A program was started to eradicate an uncontrollable protozoan disease called 'Whirling disease' caused by *Myxosoma cerebralis*, and another to develop brook trout and brown trout that are resistant to furunculosis. A screening program was conducted for a drug or drugs which can be fed in the normal hatchery diet to control external parasites on trout and to work out details of the most effective dosage and daily feeding schedule. Regarding residual drugs in hatchery trout, an attempt was made to clear pyridylmercuric acetate with the Federal Food and Drug Administration for therapy of gill disease and certain external parasites of hatchery salmonids to prevent serious mortalities. Several lots of eggs from infected coho salmon were treated with Thimersol, Acriflavine, and Terramycin, respectively, to study residual bactericidal activity. (Jones-Wisconsin)  
W74-00229

#### SOME BIOLOGICAL ASPECTS OF CHANNEL CATFISH VIRUS DISEASE,

Auburn Univ., Ala.

J. A. Plumb.

Available from the National Technical Information Service as COM-72-11301, \$3.00 in paper copy, \$1.45 in microfiche. Ph D Thesis supported by National Marine Fisheries Service, Report NOAA-72091907, June 1972. 130 p, 13 fig, 17 tab, 57 ref. 2-151 R.

Descriptors: \*Fish diseases, \*Channel catfish, \*Viruses, \*Epizootiology, Assay, Electron microscopy, Water temperature, Vectors (Biological), Mortality, \*Arkansas.

Identifiers: Mammoth Spring Hatchery (Ark).

History, distribution and epizootiology of Channel Catfish Virus Disease are discussed. This highly virulent, communicable virus has been isolated from 23 channel catfish fingerling epizootics in nine states with 61% of the cases coming from commercial channel catfish operations. It must be assumed, until proven otherwise, that once channel catfish are exposed to the virus, they are potential virus carriers and may transmit the disease to their offspring or other susceptible fish. All efforts to isolate virus from tissues of suspected adult carrier fish have failed even though the presence of strong neutralizing antibody in these fish indicated that they had been previously exposed. A total of 296 organ, tissue or excretory product samples were assayed from 62 adult fish. The virus was not recovered from any of these samples even though the fish had produced virus-infected offspring in previous years. The kidney, liver and intestine of virus injected fingerling channel catfish are primary organs of infection. In experimentally infected fingerling channel catfish a temperature reduction from 27-28°C to 18-19°C 24 hours after infection reduced mortality 60-80% and 5-35% when temperature was reduced on appearance of clinical signs of the disease. (Jones-Wisconsin)  
W74-00231

#### EFFECTS OF UNDERWATER DEMOLITION ON THE ENVIRONMENT IN A SMALL TROPICAL MARINE COVE,

Naval Underwater Systems Center, New London, Conn. New London Lab.

C. L. Brown, Jr., and R. H. Smith.

Available from the National Technical Information Service as AD-754 395. Technical Report 4459, December 1972. 18 p, 7 fig, 4 ref. A-626-11.

Descriptors: \*Explosives, \*Underwater, \*Environmental effects, Excavation, Marine biology, Bays, \*Puerto Rico, Sound waves.

Identifiers: \*Cross Cay (P.R.).

Use of 4000 lb of explosives in a small cove on Cross Cay, off Puerto Rico, to clear a beach area for an access road and remove underwater and wash coral heads and boulders to create a boat lane, prompted assessment of the blasting impact on the environment and measurement of the acoustic-pressure levels and effect of the demolition on marine life. By positioning the charges, a large portion of the energy was dissipated skyward. As a result of the precautions taken to minimize damage to the environment, at a distance of 350 yd from the demolition area, the largest of the three blasts produced a pressure level of only 9.15 lbf/sq in. The prediction of a shadow-zone effect was apparently correct, since, in the deeper water outside the cove, very little damage was noticeable—only three dead fish were found. Within two hours after the last and most powerful explosion, schools of fish were observed in that area. On the following day, more fish were in the cove, indicating that the area could be recolonized in a short time. (Jones-Wisconsin)  
W74-00233

#### MUTATIONS ARISING DURING TRANSFORMATION IN THE BLUE-GREEN ALGA ANACYSTIS NIDULANS,

Liverpool Univ. (England). Dept. of Biochemistry. M. Herdman.

Molecular and General Genetics, Vol 120, No 4, p 369-378, 1973. 4 tab, 15 ref.

Descriptors: \*Genetics, \*Cyanophyta, Aquatic plants, \*Algae.

Identifiers: \*Anacystis nidulans, \*Mutations, Prokaryotic organisms, DNA.

The blue-green algae comprise a large, structurally and physiologically diverse, group of prokaryotic organisms whose genetics, in contrast to the bacteria, have been scarcely examined. Genetic transformation of *Anacystis nidulans* is described and evidence provided that genetic recombination is associated, at high frequency, with mutation. Donor material was used from two sources, namely chemically extracted DNA and extracellular nucleic acids. A high proportion of the transformants became mutant at sites which were wild type in both parental strains. Linkage was less extensive in transformation mediated by chemically extracted DNA, and this increased frequency of recombination was associated with enhanced mutation frequencies. The frequencies of recombination and mutation were varied to the same extent by changing the DNA concentration, and both processes were prevented by pretreatment of donor DNA with DNase. Mutational events are, therefore, closely associated with recombination in *A. nidulans*. The mutations are revertible and are therefore not deletions. If the mechanism of this mutational process in *A. nidulans* is similar to that in other organisms, then the high frequency of the phenomenon in this organism may greatly facilitate further study of the nature of this mutagenic step in recombination. (Jones-Wisconsin)  
W74-00234

#### CO<sub>2</sub> FIXATION BY THE BLUE-GREEN ALGA ANACYSTIS NIDULANS,

Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biochemistry.

E. R. Jansz, and F. I. Maclean.

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Canadian Journal of Microbiology, Vol 19, No 4, p 497-504, 1973. 7 tab, 26 ref.

Descriptors: \*Carbon cycle, \*Carbon dioxide, \*Cyanophyta, Biochemistry, Cytological studies, Enzymes, Amino acids, Photosynthesis.

Identifiers: \*Anacystis nidulans, \*Carbon dioxide fixation, Carboxylation, Transcarboxylation.

Route of carbon dioxide fixation was investigated by examining early products of carbon dioxide fixation in *Anacystis nidulans*, and by investigating in cell extracts possibilities for carboxylation and transcarboxylation reactions. Two types of patterns were observed: In type I fixation 3-phosphoglycerate was the most heavily labeled initial product and in type II fixation the most intensely labeled initial product was aspartate. In type II patterns the bulk of the label in aspartate was in C4 suggesting a carboxylation of phosphoenolpyruvate. C14 incorporation into oxaloacetate was found much less than into aspartate. Ribulose-1,5-diphosphate carboxylase activity (sufficient to account for 20% manometric photosynthesis rates) and phosphoenolpyruvate carboxylase activity (sufficient to account for whole-cell rates of aspartate synthesis) were observed in cell-free extracts. Phosphoenolpyruvate-stimulated carboxylation of ribulose diphosphate was not detected indicating the label in aspartate was not a reflection of a pathway involving transcarboxylation of oxaloacetic acid. Early label detected in glutamate-1-C14 probably arose from oxaloacetate-4-C14 via citric acid cycle rather than by reductive carboxylation of succinic acid as a  $\alpha$ -ketoglutarate synthetase activity was not detected in extracts. Calvin cycle was the major route of carbon dioxide fixation. A second, minor path was carboxylation of phosphoenolpyruvate. (Jones-Wisconsin) W74-00236

#### LIMITING STEPS IN PHOTOSYSTEM II AND WATER DECOMPOSITION IN CHLORELLA AND SPINACH CHLOROPLASTS,

Institut de Biologie Physico-Chimique, Paris (France).

B. Bouges-Bocquet.

Biochimica et Biophysica Acta, Vol 292, No 3, p 772-785, 1973. 7 fig, 18 ref.

Descriptors: \*Photoactivation, \*Biochemistry, \*Chlorella, Photosynthesis, Activation energy, Chemical reactions.

Identifiers: \*Chloroplasts, Photosystem II.

During water decomposition and oxygen evolution performed by Photosystem II in green plants, it has been shown that four consecutive photochemical reactions per center are necessary for an oxygen molecule production. States refer to the general state of a center which comprises its oxidizing and reducing sides, and differs according to the number of charges stored on the oxidizing side of Photosystem II. During a short flash a photochemically inactive state is formed. A dark reaction leads to the photochemically active state. During a short saturating flash, each photochemical center reacts once and only once. Only states So and Sl are stable in the dark where there is an equilibrium between So and Sl. New results with regard to this equilibrium are presented which provide a useful tool for study of reactions. By varying redox potential of a chloroplast suspension, new evidence was obtained for an equilibrium between state So and Sl. Limiting steps between two consecutive photoreactions of System II in Chlorella and spinach chloroplasts and the limiting steps in the presence of low concentration of hydroxylamine were studied. Results favor the binding of two molecules of hydroxylamine to every photochemical center. (Jones-Wisconsin) W74-00238

#### THE EFFECTS OF CARBON DIOXIDE CONCENTRATION ON OXYGEN EVOLUTION AND FLUORESCENCE IN

#### SYNCHRONOUS CULTURES OF CHLORELLA PYRENOIDOSA,

Rochester Univ., N.Y. Dept. of Biology.

R. E. Slovacek, and T. T. Bannister.

Biochimica et Biophysica Acta, Vol 292, No 3, p 729-740, 1973. 8 fig, 27 ref.

Descriptors: Biochemistry, \*Photosynthesis, \*Carbon dioxide, \*Fluorescence, Chlorella, Photosynthetic oxygen, Chlorophyll, Biomass, Cytological studies.

Identifiers: \*Fluorescence transients, \*Chlorella pyrenoidosa, Electron transport.

A new example of parallelism of electron transport and fluorescence is added in which parallelism is manifested not only in the steady-state (fluorescence and oxygen evolution declining together as CO<sub>2</sub> concentration falls), but also during induction (both oxygen evolution and fluorescence first increasing in the M2-P3 phase, then falling during the P3-S phase). Steady-state fluorescence yield of *Chlorella pyrenoidosa* is strongly affected by carbon dioxide concentration, being approximately two-fold higher in presence than in absence of carbon dioxide. In the presence of saturating carbon dioxide during induction, accelerating oxygen evolution is paralleled by rising fluorescence; in the absence of carbon dioxide, fluorescence yield remains at low level. Both illumination and carbon dioxide content are important in determining the steady-state fluorescence yield: at lower illuminations, lower concentrations of carbon dioxide are required to obtain a maximum fluorescence yield. The effects of carbon dioxide on induction in 16-hour cells are shown. The carbon-dioxide dependent fluorescence rise is most readily observed in cells harvested early in the light period of a synchronous culture, but it can also be elicited in cells harvested during the dark period. Addition of DCMU to carbon dioxide-deprived cells raises the fluorescence yield approximately four-fold. (Jones-Wisconsin) W74-00239

#### THE AMINO ACID AND SUGAR COMPOSITION OF DIATOM CELL-WALLS,

Woods Hole Oceanographic Institution, Mass.

R. E. Hecky, K. Mopper, P. Kilham, and E. T. Degens.

Marine Biology, Vol 19, No 4, p 323-331, 1973. 3 fig, 3 tab, 29 ref.

Descriptors: \*Silica, Biochemistry, \*Cytological studies, \*Diatoms, \*Amino acids, Carbohydrates, Evolution.

Identifiers: \*Silicification.

Knowledge of the chemical composition of the organic coating of diatom cell walls may clarify the silicification mechanism. Studies of the cell wall composition may offer a new approach to diatom taxonomy and evolution if the cell wall constituents are as variable as the frustule microstructure, now the basis of diatom systematics. Understanding molecular nature of this organic coating and its probable fate in aquatic and sedimentary environments has important consequences for the geochemical cycle of silica and for paleoecological studies. Amino acid and sugar composition of cell walls from six diatom species are described. Species were selected on the basis of taxonomic and habitat diversity, as well as availability in culture. When compared to cellular protein, cell-wall protein is enriched in serine plus threonine and glycine, and depleted in acidic, sulfur-containing and aromatic amino acids. Sugars of the cell-wall carbohydrates are quite variable, and fucose tends to replace glucose in estuarine species. Condensation of silicic acid, in epitaxial order, on a protein template enriched in serine and threonine, is suggested as the Si-depositing mechanism. Nature of this template and polysaccharides in the cell wall may determine diatom frustule solubility in various environments. (Jones-Wisconsin) W74-00240

#### EFFECTS OF ARTIFICIAL DESTRATIFICATION ON ZOOPLANKTON IN PARVIN LAKE, COLORADO,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Sciences.

R. T. Lackey.

Transactions of American Fisheries Society, Vol 102, No 2, p 450-452, 1973. 1 tab, 8 ref.

Descriptors: \*Destratification, \*Zooplankton, \*Colorado, Crustaceans, Daphnia, Rotifers, Copepods, Spatial distribution, Water management (Applied).

Identifiers: \*Parvin Lake (Colo.), Daphnia schodleri, Diatomus.

Lake destratification is becoming an increasingly common tool in attempts to solve certain water management problems, but effects on biological components have been poorly defined. Effects of destratification on zooplankton abundance and depth distribution of Parvin Lake, Colorado, are described. This lake, a 19 ha montane reservoir, was artificially destratified for one year. The study consisted of a control year (November 1968-October 1969) and a treatment year (November 1969-October 1970). During the treatment year the destratification system was in continuous operation. Zooplankton was sampled at three stations: the deepest part of the lake (10m), the 6-m contour, and the 2-m contour. Horizontal differences in abundance between stations were not detected by initial data analysis, so counts for a given stratum were averaged. From these average values, a lake mean for each taxon was calculated. Abundance of cladocerans (collectively) was lower during winter months and higher during summer months of the destratification year. Abundance of copepods (mainly *Diatomus* spp.) was not statistically different during destratification. Depth distribution of zooplankton was generally unaffected, but *Diaptomus* tended to occur in deeper water during the destratification year. (Jones-Wisconsin) W74-00243

#### LAKE HURON: EFFECTS OF EXPLOITATION, INTRODUCTIONS, AND EUTROPHICATION ON THE SALMOID COMMUNITY,

Department of Lands and Forests, Maple (Ontario) Research Branch.

A. H. Berst, and G. R. Spangler.

Journal Fisheries Research Board of Canada, Vol 29, No 6, p 877-887, 1972. 8 fig, 27 ref.

Descriptors: \*Fish populations, \*Lake Huron, \*Fish harvest, \*Salmonids, Commercial fishing, Fish food organisms, Water pollution effects, Pollutants, Nets, Sport fish, Lake fisheries, Lake trout, Chinook salmon, White bass, Competition, Walleye, Predation, Thermal pollution, Exploitation, Cisco, Suckers, Yellow perch, Carp, Sauger, Pikes, Rainbow trout, Brown trout, Smelts, Salmon.

Identifiers: Burbot, Whitefish, Lake sturgeon, Chubs, Alewives, Spalke, Coho salmon, Kokanee salmon.

A dramatic decline in commercially valuable fish and an instability in fisheries resources has occurred in Lake Huron since the 1940s, although the water quality has deteriorated only slightly since the early 1800s. The only significant water quality changes are confined to areas adjacent to centers of human activity, chiefly Saginaw Bay and harbors and estuaries in Georgian Bay and the North Channel. The lake has supported a commercial fishery which produced annual catches as high as 13,000 metric tons. Sea lamprey invasion had a leading role in adversely affecting the fisheries together with instances of over-fishing and water quality deterioration in Saginaw Bay with the resultant dramatic changes in fish populations. Although lake trout in the major basins were exterminated by lampreys, other large species including rainbow trout, whitefish, suckers, and burbot have

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persisted. The present depressed state of the fisheries will undoubtedly continue until sea lamprey control is achieved and climax predator are reestablished. Canadian and United States governments are proceeding toward water quality criteria and fishery management practices which, hopefully, will stabilize the fisheries and prevent further deterioration. (Jones-Wisconsin)  
W74-00244

**ORIENTATION OF CHLOROPHYLL IN VIVO. STUDIES WITH MAGNETIC FIELD ORIENTED CHLORELLA,**  
New York Univ., New York. Radiation and Solid State Lab.

J. F. Becker, N. E. Geacintov, F. Van Nostrand, and R. Van Meter.  
Biochemical and Biophysical Research Communications, Vol 51, No 3, p 597-602, 1973. 2 fig, 16 ref.

Descriptors: Biochemistry, \*Chlorophyll, \*Cytological studies, \*Anisotropy, \*Chlorella, Lipids, Fluorescence, Pigments, Molecular structure, Polarity.

Identifiers: Orientation, Fluorescence polarization, Chloroplasts, Magnetic field.

The study of orientation in magnetic fields yields information about the orientation of pigments in vivo. It is shown that oriented forms of chlorophyll are most probably responsible for the observed magnetic phenomena, rather than the lipid molecules. Studies of the wavelength dependence of the fluorescence polarization indicate that the bulk of the chlorophyll-a is highly oriented, whereas the short wavelength spectroscopic forms of chlorophyll are either unoriented or possess a low degree of orientation. The orientation of whole cells of Chlorella pyrenoidosa in aqueous suspensions is due to the anisotropy in the diamagnetic susceptibility of oriented chlorophyll molecules. The lipid molecules tend to align with their long axes parallel to the magnetic field and the red Q-y transition moment of chlorophyll perpendicular to the field, thus in the plane of the lamellae. The plane of the porphyrin rings tends to be parallel to the magnetic field because of the large diamagnetic susceptibility perpendicular to the ring. The porphyrin ring planes tilt away from the lamellar plane by an angle greater than 45 degrees. The short wavelength spectroscopic forms of chlorophyll are unoriented. (Jones-Wisconsin)  
W74-00245

**HOLOGRAPHIC MICROSCOPY OF DIATOMS,**  
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Physics.

S. P. Almeida, D. R. Del Balzo, J. Cairns, Jr., K. L. Dickson, and G. R. Lanza.  
Transactions of the Kansas Academy of Science, Vol 74, No 3 and 4, p 257-260, 1971. 2 fig, 10 ref.

Descriptors: \*Analytical techniques, \*Microscopy, \*Cytological studies, \*Diatoms, Cameras.  
Identifiers: \*Holographic microscopy, Cyclotella, Navicula.

Holographic microscopy techniques provide another means for enhancing the study of microscopic organisms. One method for producing diatom holograms is presented. Characteristic of this group of microorganisms is encasement in a fairly rigid silicon dioxide frustule and a reasonable degree of transparency. The transparency factor led to a highly illuminated background which, in initial experiments, gave rise to poor holograms. Subsequent technique modifications corrected this situation. A schematic of the optical system used to construct and reconstruct diatom holograms is given. A 15mW Helium-Neon gas laser provides the coherent light source. After the variable beam splitter, two spatial filters SPI and SP2 of 25 and 12 microns diameter respectively and 20X are used to render the beam relatively clean from diffrac-

tion by dust particles preceding them in the optics. The signal beam is then passed through a Bausch and Lomb micro-projector in order to magnify the specimen. The excess background light accompanying the micro-projected image which produced inadequate holograms is corrected. The reconstructed images of Navicula sp. and Cyclotella sp. holograms are photographed. (Jones-Wisconsin)  
W74-00247

**WATER QUALITY AND FISH LIFE BELOW SEWAGE OUTFALLS,**  
Maryland Univ., College Park. Natural Resources Inst.

Chu-fa Tsai.  
Transactions of the American Fisheries Society, Vol 102, No 2, p 281-291, 1973. 9 fig, 1 tab, 23 ref.

Descriptors: \*Outfall sewers, \*Water pollution effects, \*Fish, \*Sewage effluents, \*Outlets, Sewage treatment, Virginia, Maryland, Pennsylvania, Chlorine, Turbidity, Alkylbenzene sulfonates, Toxins, Conductivity, Ammonia.

Identifiers: Species diversity.

The relationship between degree of water quality degradation and degree of fish community depletion below sewage effluent outfalls were studied. The objectives were to find the maximum limit of water quality degradation for each fish species, and eventually to establish water quality criteria to protect fish communities in sewage-polluted streams. Comparative studies were made of water quality and fish species diversity in stream locations immediately above and below the outfalls of 149 secondary sewage treatment plants in Virginia, Maryland, and Pennsylvania. There was a wide variation among species in sensitivity to total chlorine and turbidity parameters. While present technology does not approach that stage of complete sewage purification that will meet a stream's needs, natural purification may be considered as a supplement to present sewage treatments. To help achieve appropriate water quality objectives, several modifications of plant design and site selection for sewage disposal are proposed. Although sewage disinfection by chlorination is essential at present, in order to avoid damage to fish life, dechlorination by means of effluent holding lagoons, in addition to engineering facilities at sewage treatment plants, are recommended. (Jones-Wisconsin)  
W74-00248

**PHYSICAL AND CHEMICAL LIMNOLOGY OF LAKE LEAKE AND TOOMS LAKE, TASMANIA,**  
Tasmania Univ., Hobart (Australia). Dept. of Botany.

R. L. Croome, and P. A. Tyler.  
Arch Hydrobiol. Vol 70, No 3, p 341-354, 1972. 11 figs.

Identifiers: \*Australia (Tasmania lakes), Lakes, \*Limnology, Minerals, \*Ions.

The physico-chemical limnology of 2 shallow lakes in eastern Tasmania, Australia is described. They are characterized as oligotrophic, homothermic, O2 saturated and turbid. The cationic dominance order Na > Mg > Ca > K occurs in water, ooze and inflows. Total ionic concentrations are less than 1 meq/l. Slight differences in limnology are related to lake shape and catchment ecology.—Copyright 1973, Biological Abstracts, Inc.  
W74-00283

**ENZYMATIC REMOVAL OF OIL SLICKS,**  
Oklahoma State Univ., Stillwater. Dept. of Biochemistry.

For primary bibliographic entry see Field 05G.  
W74-00284

**POLLUTED SNOW IN SOUTHERN NORWAY AND THE EFFECT OF THE MELTWATER ON FRESHWATER AND AQUATIC ORGANISMS,**  
Oslo Univ. (Norway). Zoological Lab.

A. Hagen, and A. Langeland.  
Environmental Pollution, Vol 5, No 1, p 45-57, July 1973. 5 fig, 4 tab, 29 ref.

Descriptors: \*Melt water, \*Water pollution effects, \*Aquatic animals, Snowmelt, Oligotrophy, Dystrophy, Physicochemical properties, Surface waters, Iced lakes, Snow cover, Trophic level, Chemical analysis, Water analysis, Acidity, Nitrates, Sulfates, Zinc, Heavy metals, Water quality, Environmental effects, Sampling, Hydrogen ion concentration, Electrical conductance, Conductivity, Alkalinity, Nitrogen, Nitrates, Sulfates, Calcium, Magnesium, Lead, Iron, Manganese, Cadmium, Copper, Oligochaetes, Zooplankton, Biota, Benthic fauna, Water pollution, Clams, Midges.

Identifiers: \*Snow contamination, \*Norway, Ovre Lomtjorn, Lake Flovatn, Sialis, Chironomids, Pisidium.

In winter, surface water in some oligo-dystrophic lakes in southern Norway differed physico-chemically from what might be expected. Analyses of snow and of ice-trapped and surface water showed that polluted snow had a considerable influence on the quality of water in lakes and brooks in the winter and spring. Great quantities of, for example, SO4 (2 minus), NO3 (minus), Zn and Pb were found together with high acidity. The Zn concentration and acidity found are known to be dangerous to fish. The contaminants in general have probably had a negative effect on fish and invertebrates. It is probable that oligotrophic lakes are more susceptible to contamination than dystrophic lakes. (Holoman-Battelle)  
W74-00287

**ORGANOCHLORINE RESIDUES IN ESTUARINE MOLLUSKS, 1965-72 - NATIONAL PESTICIDE MONITORING PROGRAM,**  
Environmental Protection Agency, Gulf Breeze, Fla. Office of Pesticide Programs.

P. A. Butler.  
Pesticides Monitoring Journal, Vol 6, No 4, p 238-362, March 1973. 15 fig, 20 tab, 17 ref.

Descriptors: \*Mollusks, \*Chlorinated hydrocarbon pesticides, \*Polychlorinated biphenyls, \*Pesticide residues, \*Pollutant identification, Clams, Mussels, Oysters, Persistence, Watersheds (Basins), Path of pollutants, Chemical analysis, Water sampling, Invertebrates, Aquatic animals, Marine animals, Endrin, DDT, Insecticides, DDD, Monitoring, DDE, Dieldrin, Aldrin, Heptachlor, Solvent extractions, Water pollution sources, Benthic fauna, Chesapeake Bay, Delaware River, Estuaries, River basins.

Identifiers: \*Biomonitoring, Sample preparation, Data interpretation, Chemical recovery, Coastal waters, Bioaccumulation, Marine environment, Fate of pollutants, Machipongo River, Rappahannock River, York River, James River, Elizabeth River, Lynnhaven Bay, Sequim Bay, Puget Sound, Samish Bay, Padilla Bay, Lummi Bay, Bear River, Naselle River, Nemah River, Macroinvertebrates, Quahog, Soft shell clam, Mirex.

The development of the national program for monitoring estuarine mollusks in 15 coastal states is described and the findings for the period 1965-72 are reported. The report is presented in two parts: Part I. General Summary and Conclusions, and Part II. Residue Data - Individual States. Analyses of the 8,095 samples for 15 persistent organochlorine compounds showed that DDT residues were ubiquitous; the maximum DDT residue detected was 5.39 ppm. Dieldrin was the second most commonly detected compound with a maximum residue of 0.23 ppm. Endrin, mirex, toxaphene, and polychlorinated biphenyls were found

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects of Pollution

only occasionally. Results indicate a clearly defined trend towards decreased levels of DDT residues, beginning in 1969-70. At no time were residues observed of such a magnitude as to imply damage to mollusks; however, residues were large enough to pose a threat to other elements of the biota through the processes of recycling and magnification. (Holoman-Battelle)  
W74-00291

**MERCURY: ENVIRONMENTAL CONSIDERATIONS, PART I,**  
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.  
P. A. Krenkel.  
CRC - Critical Reviews in Environmental Control, Vol 3, No 3, p 303-373, May 1973. 22 fig, 32 tab, 399 ref.

Descriptors: \*Mercury, \*Ecological distribution, \*Aqueous environment, \*Chemical analysis, \*Water pollution sources, \*Water pollution effects, \*Water pollution, \*Air pollution, \*Soil contamination, \*Documentation, \*Analytical techniques, \*Reviews, Municipal wastes, Ice cover, Food chains, Aquatic life, Bioassay, Methodology, Farm wastes, Domestic wastes, Solid wastes, Human diseases, Toxicity, Water analysis, Inorganic compounds, Aquatic populations, Freshwater fish, Marine fish, Rocks, Freshwater, Saline water, Aquatic soils, Industrial wastes, Paths of pollutants, Environmental effects, Groundwater, Sewage effluents, Aqueous solutions, Soil analysis, Heavy metals, Ecosystems, Absorption, Ions, Cations, Poisons, Fishkill, Fish populations, Wildlife, Aquatic microorganisms.  
Identifiers: \*Organomercury compounds, \*Snow contamination, Methylation, Biotransformation, Biological magnification, Bioaccumulation, Natural waters, Hydrogeochemistry, Mercury radioisotopes, Geochemical cycles, Chemical concentration, Detection limits, Fate of pollutants, Degradation products, Decontamination, Sample preparation, Biological half-life, Median tolerance limit, Mercury compounds, Organometalics, Alkymercury, Minamata disease, Mobile River, Biological samples.

The mercury problem is defined in relation to its sources, environmental distribution, biological transformations, decontamination potential and physiological effects. Included are additional sections on total mercury analysis and methylmercury analysis in which are reviewed sample preparation and methods of analysis. (Holoman-Battelle)  
W74-00292

**A SYSTEMATIC SURVEY OF INTERTIDAL OYSTERS IN THE SAVANNAH RIVER BASIN AREA OF SOUTH CAROLINA,**  
South Carolina Wildlife and Marine Resources Dept., Charleston. Marine Resources Center.  
M. D. McKenzie, and A. C. Badger.  
Available from NTIS, Springfield, Va., 22151 as COM-72-11059 Price \$3.00 printed copy; \$1.45 microfiche. Bears Bluff Laboratories Contribution No 50, February 1969. 15 p, 4 fig, 2 tab, 8 ref.

Descriptors: \*Oysters, \*Water pollution effects, \*Estuaries, \*South Carolina, Fisheries, Shellfish, Surveys, Fish populations, Spawning, Growth rates, Fish management, Ecosystems, Ecology, Aquiculture.  
Identifiers: \*Wright River (SC), \*New River (SC).

Surveys of the position, extent, and biological characteristics of intertidal oyster beds in the Wright-New River area of South Carolina were conducted in 1965 and 1968. Results were compared with earlier surveys. The Wright-New River area is a highly productive seed oyster area. Although pollution is a major problem, oysters appear to thrive within the septic zone, and consequently, are in a condition of overcrowding. Ecologically, this situation is not advantageous for

harvesting shucking stock at the present time. However, such conditions can be profitably utilized in establishing seed areas for the sole purpose of rearing oysters for transplants. Assuming these waters could be deemed suitable for the cultivation of oysters fit for human consumption, a highly desirable variety of oysters could probably be harvested within two years following applied techniques of aquiculture. (Woodard-USGS)  
W74-00300

**LAND USE AS A FACTOR IN COASTAL WATER QUALITY,**  
California Univ., Berkeley.  
For primary bibliographic entry see Field 02L.  
W74-00383

**PROVOKING EFFECT OF IODOBROMIC WATERS IN LEPROSY, (IN RUSSIAN),**  
P. M. Zorin.  
Vestn Dermatol Venerol. Vol 46, No 2, p 66-68, 1972. English summary.  
Identifiers: Human diseases, \*Iodobromic water, \*Leprosy, Water.

A woman of 58 who started balneological treatment for hypertension of II A degree and non-specific polyarthritis developed after 5 iodobromic baths numerous spots and plaques which were diagnosed as leprosy of lepromatous type. The diagnosis was subsequently confirmed by bacteriologic immunologic and histopathological examinations. Anamnestically similar efflorescences was observed during the past 2 yr, but their nature was not recognized in time. Before admission to balneological therapy manifestations of leprosy were absent. As a result of resorption from the bath of iodine to which patients with leprosy are particularly sensitive, the patient developed clinical exacerbation of leprosy. Physicians of resorts and local balneoclinics should carefully study all patients arriving for treatment in order not to overlook patients with leprosy.—Copyright 1973, Biological Abstracts, Inc.  
W74-00403

**THE EFFECT OF FEEDING LAYING HENS VARIOUS LEVELS OF COW MANURE ON THE PIGMENTATION OF EGG YOLKS,**  
Tennessee Univ., Knoxville. Dept. of Poultry.  
L. H. Littlefield, J. K. Blettner, and O. E. Goff.  
Poultry Science, Vol 52, No 1, p 179-181, January, 1973. 3 tab, 10 ref.

Descriptors: \*Recycling, Cattle, \*Farm wastes, Poultry, \*Diets.  
Identifiers: \*Blood xanthophyll levels, \*Yolk pigmentation, Blood.

Dried cow manure was added at the rate of 0, 2.5, 5, or 10 kilograms per 100 kilograms of diets containing 0 and 23 milligrams of xanthophylls per kilogram of diet to determine the effect on blood xanthophyll levels and the pigmentation of yolks produced by hens on these diets. There was a high positive linear correlation between the amount of cow manure added and the amount of xanthophyll in the blood, the amount of xanthophyll in the egg yolk, and the yolk visual score. There was a high negative linear correlation between pigmentation efficiency and the amount of cow manure added to the diet. Although cow manure was a good source of xanthophylls, it was not efficiently utilized by the hen as a source of xanthophylls. (East Central)  
W74-00407

**TOXICITY OF DROPPINGS FROM COUMAPHOS-FED HENS TO LITTLE HOUSE FLY LARVAE,**

Massachusetts Univ., Amherst. Dept. of Entomology and Plant Pathology.  
J. W. Eversole, J. H. Lilly, and F. R. Shaw.  
Journal of Economic Entomology, Vol 58, No 4, p 709-710, August 1965. 1 tab, 4 ref.

Descriptors: \*Poultry, \*Farm wastes, \*Toxicity, \*Insecticides, Massachusetts.

Identifiers: Flies, Larval mortality, Coumaphos oral drench powder, *Fannia canicularis*, White leghorn hens.

White leghorn hens were fed mixtures of 50% coumaphos oral drench powder, and pelleted poultry feed. The insecticide levels were 0, 25, 75, and 125 mg of active ingredient per kg of feed. The mean mortalities of larvae of *Fannia canicularis* (L) exposed to the droppings from these birds were 7.3, 18.0, 42.5, and 91.0%, respectively. Therefore coumaphos provided an effective degree of control when fed at the 125 mg/kg level. By a comparison of the concentrations of coumaphos required to produce approximately 90% mortality of the fly larvae in this field test with the results of laboratory tests, it was estimated that approximately a 70-fold decrease in effectiveness occurred during passage of the insecticide through the birds. (East Central)  
W74-00410

**TOXICITY TO HOUSE FLIES AND HORN FLIES OF MANURE FROM INSECTICIDE-FED CATTLE,**  
Agricultural Research Service, Kerrville, Tex. Entomology Research Div.  
For primary bibliographic entry see Field 05G.  
W74-00423

**PERIODICITY OF THE BLUE-GREEN ALGAE AND THEIR EFFECT ON THE EFFICIENCY OF MANURE-DISPOSAL LAGOONS,**  
Agricultural Research Service, Washington, D.C. Agricultural Engineering Research Div.  
For primary bibliographic entry see Field 05D.  
W74-00430

**OBSERVATIONS ON THE NITROGEN FIXING POTENTIAL OF THE SURFACE WATERS OF A LARGE IMPOUNDMENT,**  
Oklahoma State Univ., Stillwater. Dept. of Zoology.  
R. W. Hall, Jr., and D. W. Toetz.  
The Southwestern Naturalist, Vol 18, No 1, p 94-97, March 30, 1973. 3 fig. OWRR A-012-OKLA. (3), FWQA 5+1-UP-185-01.

Descriptors: \*Nitrogen fixation, Reservoir, Nitrate, Ammonia, Light, \*Oklahoma, Impoundments, \*Cyanophyta, Seasonal.  
Identifiers: \*Keystone Reservoir (Okla), Inoculum.

Information of comparative limnological interest is provided on the nitrogen fixing potential of the surface waters of Keystone Reservoir, Oklahoma, and the annual cycle there of phenomena, which can control the rate of N<sub>2</sub> fixation: temperature, light as Secchi disc transparency, the concentrations of inorganic nitrogen and species composition of the phytoplankton. The surface water of this lake had a very low N<sub>2</sub> fixing potential, since acetylene reduction was not observed. Limnological conditions were favorable for N<sub>2</sub> fixation by blue-green algae during the summer. However, the following blue-green algae, identified in plankton samples, are not known to fix N<sub>2</sub>: *Chroococcus*, *Merismopedia*, *Oscillatoria* and *Lyngbya*. It is speculated that N<sub>2</sub> fixing algae did not develop a bloom because of the lack of a suitable inoculum.  
W74-00436

**MAN'S EFFECT ON THE GREAT LAKES,**  
For primary bibliographic entry see Field 04C.  
W74-00444

**ECOLOGY AND PRODUCTION OF THE PROFUNDAL BENTHOS IN RELATION TO PHYTOPLANKTON IN LAKE ESROM,**  
Copenhagen Univ. (Denmark). Freshwater Biological Lab.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Effects of Pollution—Group 5C

P. M. Jonasson.

OIKOS Supplementum, Vol 14, p 1-148, 1972. 94 fig, 45 tab, 357 ref.

**Descriptors:** \*Benthic fauna, \*Ecology, \*Phytoplankton, \*Secondary productivity, \*Profundal zone, \*Hypolimion, \*Environmental effects, Aquatic insects, Food habits, Life cycles, Growth rates, Mollusks, Annelids, Biorhythms, Mortality, Dominant organisms, Annual turnover, Standing crops, Aquatic plants, Crustaceans, Aquatic algae, Aquatic bacteria, Energy budget, Rotifers, Invertebrates, Tubificids, Benthos, Midges, Diptera, Eutrophication, Trophic level, Carnivores, Food chains, Water properties, Ice cover, Primary productivity.

**Identifiers:** Seasonal variation, Insect physiology, Nutrient supply, Seasonal succession, Energy flow, \*Denmark (Lake Esrom), Detritivores, Transparency, Macrophytes, Chironomus anthracinus, Chironomids, Ilyodrilus hammoniensis, Pisidium casertanum, Chaborus flavicans, Procladius pectinatus, Macroinvertebrates, Chemical composition, Biochemical characteristics, Population density, Phantom midges, Nutrient availability.

Morphometric and environmental data of the 17.3 sq km and 22 m deep dimictic, eutrophic Lake Esrom, Denmark are given. The seasonal variation in solar radiation, temperature, oxygen, specific conductivity, pH, transparency, ionic composition, and its relationship to primary production of phytoplankton was measured over 10 years. A spring maximum of diatoms usually occurs in April after the ice cover has gone and a summer maximum of bluegreens occurs in August. The seasonal succession is correlated with duration of ice cover, solar radiation, temperature, and nutrient supply. Mean annual phytoplankton gross production was 260 g C/sq m/yr, with a range from 170 to 330 g C/sq m/yr (2,440 kcal/sq m/yr). Net production, estimated at 75 percent of the gross production, consequently, was 195 g C/sq m/yr (1,830 kcal/sq m/yr). A comparison is made with some 20 lakes, mostly Danish, on a yearly basis. The essential relationships between environment, food, growth, life cycles, and population dynamics are described for three detritivores and two carnivores: Insects dominate secondary production, which amounts to 100 kcal/sq m/yr. Mortality in the detritivores is high (3.59 kcal/sq m/yr) but lower in the carnivores (2.6 and 1.3 kcal/sq m/yr). Other losses are due to emergence. Turn over rates are rather low. Respiratory metabolism of the benthos includes measurements of aerobic population respiration of the five species at all seasons. Community respiration of the macrofauna amounted to 432 kcal/sq m/yr, or more than four times the secondary production. The production of profundal benthos in the lake is compared with the estimated production of zooplankton and the trophic relations between phytoplankton, zooplankton and benthos are discussed. This provides a broad picture of the energy flow in the lake. (Holman-Battelle) W74-00466

**METABOLIC EFFECTS OF TECHNICAL PENTACHLOROPHENOL (PCP) ON THE EEL ANGUILLA ANGUILLA L.,**

National Board of Fisheries, Goteborg (Sweden).

B. Holmberg, S. Jensen, A. Larsson, K.

Lewander, and M. Olsson.

Comp Biochem Physiol B Comp Biochem. Vol 43, No 1B, p 171-183. 1972. Illus.

**Identifiers:** \*Anguilla-anguilla, \*Eels, \*Metabolism, \*Pentachlorophenol, Pesticides, Phenols.

Eels (*A. anguilla* L.) were exposed to sea water and fresh water containing 0.1 ppm pentachlorophenol (PCP). The accumulation of the pesticide as well as the effects on different metabolites in blood, muscle and liver were studied. PCP exposure caused changes, indicating a hypermetabolic state with accelerated utilization of tissue energy reserves. An altered cholesterol

metabolism, a decreased activity of liver glutamate pyruvate transaminase (GPT) and an enlargement of the liver suggested a disturbed liver function. The effects of PCP seemed to persist in spite of a recovery period in clean water for about 2 mo.—Copyright 1973, Biological Abstracts, Inc. W74-00482

#### THE EFFECT OF KCL IN DRINKING WATER ON MILK SECRETION AND COMPOSITION, (IN RUMANIA),

Institutul de Cercetari Zootechnice, Bucharest (Romania). Lab. for the Fisiology of Animals.

D. Popovici, and M. Raitaru.

Stud Cercet Biol Ser Zool. Vol 24, No 3, p 209-214. 1972. (English summary).

**Identifiers:** Chlorides, Cows, \*Milk, \*Potassium chloride, \*Potable water.

The effect of KCl added to drinking water (1g 0/0) on milk yield and composition was studied on a group of 6 cows. In these conditions water consumption and the percentage of milk fats increase. Milk production and protein concentration are relatively constant. An increase of water K concentration is observed while Na concentration remains relatively constant. The effects of KCl added to drinking water are maintained also in the following period, when animals drink unaltered water.—Copyright 1973, Biological Abstracts, Inc. W74-00483

#### ECOLOGICAL STUDIES ON THE PENAUS ORIENTALIS KISHINOUエ CULTURED IN A POND FILLED WITH SEA WATER: I. GROWTH RATE AS RELATED TO THE SUBSTRATE MATERIALS, SURVIVAL RATE, PREDATOR OF *P. ORIENTALIS*, AND WATER CONDITIONS OF CULTURING POND, Seoul National Univ. (Republic of Korea). Coll. of Education.

K. C. Choi, and Y. K. Song.

Bull Korean Fish Soc. Vol 4, No 2, p 47-54. 1971. Illus.

**Identifiers:** Acanthogobius-Flavimanus, Culturing, Ecological studies, \*Growth rates, \*Penaeus-Orientalis, Ponds, Predator, Sea water, Survival.

The differences in growth rate of *P. orientalis* cultured on muddy bottom region and sandy bottom region in a pond filled with sea water were studied. For the investigation of the growth rate, the body length and the body weight were determined. Five individuals from each experimental region were sampled at random. The samples were collected at 10-day intervals. The survival rate, the predator of *P. orientalis*, and the water conditions during the experimental period were also determined. The growth rate of *P. orientalis* which was cultured in the muddy bottom region was greater than that in the sandy bottom region, regardless of whether they were cultured with or without food. When the predator is not present, 84% of *P. orientalis* may survive. Acanthogobius flavimanus is one of the predator of *P. orientalis*. The variation of water conditions of the pond, in which water had been exchanged 12 times per month, did not affect to the survival rate of *P. orientalis*.—Copyright 1973, Biological Abstracts, Inc. W74-00486

#### ROLE OF ULTRANANOPLANKTON ALGAE IN PRIMARY PRODUCTION IN LAKE BAIKAL DURING THE SUMMER, (IN RUSSIAN),

For primary bibliographic entry see Field 02H.

W74-00488

#### EFFECTS OF WATER POLLUTION ON THE ICHTHYOFAUNA: IV. TOXICITY OF ACIDS, ALKALIES AND SOME INORGANIC GASES, P. Epler.

Postope Nauk Roln. Vol 18, No 6, p 85-102. 1971. Illus.

**Identifiers:** \*Acids, \*Alkalies, Fauna, Fish, \*Ichthyo-fauna, Inorganic gases, Pollution, \*Toxicity, Water pollution.

Acids produce free CO<sub>2</sub>, which is lethal to fish, in water with a high bicarbonate content. Resistance to pH of the order of 3.6 rapidly grows with age in trout. Strong alkalies are toxic at pH above 10.0. Acids are generally toxic at pH below 4.0. A concentration of 1.5 mg CO<sub>2</sub>/l appears to be lethal. Free Cl is highly dangerous and forms chemical compounds of no lesser toxicity, such as chloramine and cyanogen (CN) chloride, toxic in amounts exceeding 0.1 mg ClCN/l.—Copyright 1973, Biological Abstracts, Inc. W74-00489

#### TOXICITY OF POLYCHLORINATED BIPHENYLS (PCB) TO GOLDFISH, Jyvaskyla Univ. (Finland). Dept. of Organic Chemistry.

M. L. Hattua, and O. Karlog.

Acta Pharmacol Toxicol. Vol 31, No 3, p 238-240. 1972. Illus.

**Identifiers:** \*Goldfish, Nervous systems (Fish), \*Toxicity, \*Polychlorinated biphenyls, Fish pathology.

The harmful effects of PCB were easily observed. The fish lost their appetite and their bright orange color turned to pale yellow, the changes being most obvious with the highest concentrations of PCB. The effect on the nervous system was observed as uncoordinated movements after which the fish turned to side positions. To ensure that the effects were caused by PCB and not by starvation, another control group of 16 fishes were starved in clean water for 10 days. With exception of a 25% loss of weight and 2 deaths no abnormalities were noted.—Copyright 1973, Biological Abstracts, Inc. W74-00492

#### INDUCTION OF MICROSOMAL LIVER ENZYMES AFTER POLYCHLORINATED BIPHENYLS (PCB) AND FOLLOWING STRESS, (IN GERMAN),

Hamburg Univ. (West Germany). Pharmakologisches Institut.

H. F. Benthe, A. Schmid, and H. Schmidt.

Arch Toxikol. Vol 29, No 2, p 97-106. 1972. Illus. (English summary).

**Identifiers:** \*Enzymes, Human adipose tissue, Rat liver, Tissue, \*Polychlorinated biphenyls.

One i.p. injection of PCB induces a high stimulation of rat liver microsomal drug oxidizing enzymes; equimolar doses of tetrachlorobiphenyls are distinctly more effective than dichlorobiphenyls. The effect can still be demonstrated distinctly 4 wk after application. During this time the liver concentration of tetrachlorobiphenyls decreased to 7 microgram/g tissue whereas the concentration of adipose tissue rose to 252 microgram/g. By stress tetrachlorobiphenyls are mobilized along with fat, causing an increase of liver concentration to 32 microgram/g. Simultaneously, a new stimulation of microsomal activity can be seen, nearly equal to the maximum stimulation 4 days after i.p. application of 500 mg/kg b.w. Parallel to microsomal stimulation there is an increase of relative liver weight. Stress induced activation of microsomal activity caused by PCB redistribution is important for the evaluation of PCB in environmental toxicology, in view of rising PCB concentrations in human adipose tissue.—Copyright 1973, Biological Abstracts, Inc. W74-00493

#### ZOOBENTHOS RESOURCES AND PRODUCTIVITY IN THE GULF OF TAGANROG, (IN RUSSIAN),

Azovskii Nauchno-Issledovatel'skii Institut Rybnoho Khozyaistva, Rostov-na-Donu (USSR).

M. Ya. Nekrasova.

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects of Pollution

Gidrobiol Zh. Vol 8, No 4, p 41-47. 1972. (English summary).  
Identifiers: \*Benthos, \*Productivity, Salinity, \*USSR (Taganrog Bay), Zoo benthos.

An evaluation was made of the fodder capacity of the Taganrog Bay, USSR, bottom fauna during the period of regulated flow of the Don. Resources P/B coefficients (ratio of productivity to the spring biomass) and productivity indices were calculated for this purpose. The highest P/B values was on the high and middle water level periods and was lowest on the lower water level periods. The low P/B values showed a decrease in zoobenthos reproductivity with decrease of the Don flow and increase of salinity in the bay.—Copyright 1973, Biological Abstracts, Inc.  
W74-00495

**ROLE OF BACTERIA IN THE FEEDING OF ZOOPLANKTON OF THE DNEIPER RESERVOIRS, (IN RUSSIAN),**  
Akademiya Nauk USSR, Kiev. Instytut Hidrobiologii.

D. Z. Gak.  
Dokl Akad Nauk SSSR Ser Biol. Vol 203, No 3, p 696-697. 1972. Illus.  
Identifiers: Algae, \*Bacteria, Feeding, Plankton, Reservoirs, \*USSR (Dnieper reservoir), Zoo plankton, \*Cyanophyta, \*Eutrophication.

Proof is presented on the major role of bacteria in the feeding of zooplankton of eutrophic reservoirs (USSR) blooming with blue-green algae.—Copyright 1973, Biological Abstracts, Inc.  
W74-00496

**HYDROGRAPHY, CHEMISTRY AND LOAD OF NUTRIENTS OF A MOUNTAIN STREAM POLLUTED BY ORGANIC WASTE WATER, (IN GERMAN),**

Freiburg Univ. (West Germany). Limnologisches Institut.  
U. Franke, and J. Schwoerbel.  
Arch Hydrobiol Supplement B. Vol. 42, No 1, p 95-124. 1972. Illus. (English summary).  
Identifiers: Bioactivity, Chemistry, \*German (Mettma stream), Hydrography, Mountain streams, Nutrient load, Organic wastes, Polluted streams, Waste water, \*Brewery effluents.

The Mettma stream, a small freshwater river in Germany polluted by brewery effluent, was investigated. Running water, in which organic nutrients are introduced, permanently changes its metabolism-type from the point of entry of the sewage. At the same time chemical conditions change. The stream purified itself. After a certain distance downstream there is a balance in metabolism just as there was above it, but the bioactivity is increased.—Copyright 1973, Biological Abstracts, Inc.  
W74-00499

**HYDROBIOLOGICAL INVESTIGATION OF LAKE LERE AND NEIGHBORING PONDS: I. THE PHYSICAL ENVIRONMENT, (IN FRENCH),**

Office de la Recherche Scientifique et Technique Outre-Mer, Fort Lamy (Chad).  
For primary bibliographic entry see Field 02H.  
W74-00501

**HYDROBIOLOGICAL INVESTIGATION OF LAKE LERE (CHAD) AND NEARBY PONDS: IV. THE BENTHIC FAUNA,**  
Office de la Recherche Scientifique et Technique Outre-Mer, Fort Lamy (Chad).  
For primary bibliographic entry see Field 02H.  
W74-00502

**TWO STUDIES OF PESTICIDE RESIDUES,**  
Texas A and M Univ., College Station. Environmental Quality Program.  
L. J. Dziuk, and R. E. Kramer.  
Environmental Quality Note 13, July 1973. 47 p.

Descriptors: \*Water pollution effects, \*Pesticide residue, \*Insecticides, \*Ecosystems, Environmental effects, Ecology, Fish, Fish genetics, Fish reproduction, Surface waters, Cotton, Insect control, \*Texas, Environmental effects, Aquatic life, Sampling, Resistance, Fish toxins, Data collections.  
Identifiers: \*Brazos County (Tex), \*Burleson County (Tex).

The report includes the following: A Study of Pesticide Residue Levels and Insecticide Resistance in Selected Aquatic Organisms Occurring Around the Bryan - College Station Agricultural Production Areas, by L.J. Dziuk; and A Survey of DDT Residues in Fish From the Brazos and Navasota Rivers and Somerville Reservoir, by R. E. Kramer. The phenomena of pesticide transferal and biological magnification have aroused widespread interest in the sublethal effects of pesticides on fish. Reduced reproductive capability has been demonstrated as one sublethal effect on fish. Pesticides can affect the physiological processes of a fish to point where normally non-lethal environmental stresses become lethal. Sublethal effects of several pesticides within the body of fish may combine to cause death. Continued contamination of freshwater ecosystems with DDT has resulted in varying degrees of insecticide resistance in aquatic organisms. In areas where DDT has been applied for a number of years for control of insect pests, the nontarget organisms there have been conditioned, due to genetic adaptation, to live in the contaminated environment. (See W74-00530 and W74-00531) (Woodard-USGS)  
W74-00529

**A STUDY OF PESTICIDE RESIDUE LEVELS AND INSECTICIDE RESISTANCE IN SELECTED AQUATIC ORGANISMS OCCURRING AROUND THE BRYAN-COLLEGE STATION AGRICULTURAL PRODUCTION AREAS, TEXAS A AND M UNIV., COLLEGE STATION. ENVIRONMENTAL QUALITY PROGRAM.**

L. J. Dziuk.  
In: Two Studies of Pesticide Residues Environmental Quality Note 13, p 10-24, July 1973. 2 fig.  
Descriptors: \*Pesticide residues, \*Insecticides, \*Pollutants, \*Water pollution effects, \*Aquatic life, Analytical techniques, Sampling, Fish, Surface waters, Ecosystems, DDT, Insect control, Environmental effects, Resistance, Cotton, \*Texas.  
Identifiers: \*Brazos County (Tex), \*Burleson County (Tex).

One objective was to determine at what levels DDT and its metabolites were concentrated by the aquatic organisms at various places in an intensively managed cotton-growing area of Texas. A survey was made to find a series of sites that would reflect at least some degree of pesticide use, ranging from high to virtually no contamination. A map of Brazos and Burleson Counties shows the locations of the sampling sites. Because DDT was not applied to the cotton fields in the immediate area during the sampling period, it appears that biological variability in the mosquitofish sampled may have played a large part in the extreme variation of the levels of p,p'-DDT from week to week. Insecticide resistance confers a survival advantage in an organism exposed to levels of insecticide that would prove fatal to susceptible populations. Brazos-R mosquitofish illustrate this point. DDT and toxaphene were both used in quantity in the immediate area of the fish population. These fish were able to withstand approximately 10 times

more toxaphene than a susceptible population, and approximately 12 times as much DDT as the susceptible population. If resistance had not been developed to these two compounds, the mosquitofish population might not have been able to survive such adverse conditions. (See also W74-00529) (Woodard-USGS)  
W74-00530

**A SURVEY OF DDT RESIDUES IN FISH FROM THE BRAZOS AND NAVASOTA RIVERS AND SOMERVILLE RESERVOIR,**  
Texas A and M Univ., College Station. Environmental Quality Programs.  
R. E. Kramer.

In: Two Studies of Pesticide Residues Environmental Quality Note 13, p 25-47, July 1973. 14 tab, 31 ref.

Descriptors: \*Water pollution effects, \*Aquatic life, \*Pesticide residues, \*Fish, Surface waters, Lentic environment, Lotic environment, Reservoirs, Rivers, \*Texas, Environmental effects, Insecticides, DDT, Ecosystems.  
Identifiers: \*Burleson County (Tex).

Intensive agricultural activity in the Brazos Valley, Texas, has raised questions concerning insecticide residue presence and accumulation in fish from local agroecosystems. One lentic and two lotic systems were sampled. The lentic system is Somerville Reservoir in southern Burleson County. The two lotic systems are the Brazos and Navasota Rivers. Muscle tissue of fish from all three aquatic systems contained some measurable amount of either DDE, DDD, or DDT. DDT residues were detected in samples from both lotic systems but not in those from the lentic system. DDD and DDE were detected in samples from all three aquatic systems. Fish from the Brazos River contained the highest residues of all of the fish collected. All samples analyzed contained DDE in measurable quantities. Channel catfish contained the highest average level of DDE in the muscle tissue (0.309 ppm) of any species of fish collected from the river. Freshwater drum had only slightly lower average DDE levels (0.296 ppm) than channel catfish. The lowest average DDE levels were in carp suckers at 0.163 ppm. DDD and DDT were confirmed in 52% of the samples analyzed. DDD and DDT could be quantitated only in tissue samples of channel catfish and were slightly more than 0.1 ppm. Carp was the only species other than channel catfish that consistently contained trace amounts of DDD and DDT in muscle tissue. (See also W74-00529) (Woodard-USGS)  
W74-00531

### 5D. Waste Treatment Processes

**DEVELOPMENT AND PILOT-TESTING OF AN AUTOMATIC INFORMATION DISSEMINATION SYSTEM.**  
Environmental Quality Systems, Inc., Rockville, Md.

Available from the National Technical Information Service as PB-224 501, \$4.25 in paper copy, \$1.45 in microfiche. Completion Report proposed for Water Resources Scientific Information Center, September 1973. 72 p, 2 fig, 2 tab, 31 ref, 6 append. OWRR W-175 (No 9075) (1).

Descriptors: \*Mathematical models, Computer programs, \*Information retrieval, Engineering, Design, \*Waste water treatment, Computer models, Sewage treatment, Model studies, Abstracts.

Identifiers: \*Information Centers and Services, \*Content analysis, \*Dissemination techniques, \*Consulting engineers, \*Facility design, Information systems, Information Storage and Retrieval.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Waste Treatment Processes—Group 5D

An Automatic Information Dissemination System (AIDS) flexible enough to accommodate a wide variety of user needs for technical information was developed and successfully pilot-tested. Methods for accelerating the application of research results were studied using mathematical models and computer programs useful in the design of wastewater treatment facilities as a sample technical area. Engineering firms with design experience were directly consulted to verify their needs for models and programs, and to solicit their views on effective dissemination techniques. Based on the engineers' comments, a system was developed to satisfy individual information needs by automatically disseminating the appropriate level of detail on each model or program. The levels of detail are cumulative so that in any one consulting organization some individuals may receive general notification (Step I), while others who have direct interests and responsibilities for models and programs can receive progressively more detailed information. Some individuals would receive a detailed assessment of the model's utility and a description of the reference documents available (Step II). A few individuals would receive the actual documents (Step III), and one person would receive all of the foregoing information, plus the source deck, a user's manual, and other pertinent materials (Step IV). If required, extension services would be available (Step V). Results are reviewed. Recommendations included a field evaluation and subsequent large-scale implementation. (Gaughan-EQSI)

W74-00003

#### SEWAGE TREATMENT METHOD AND APPARATUS.

Y.S. Lin, and C. F. Chang.

U. S. Patent No. 3,753,897, 5 p, 3 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 913, No 3, p 948, August 21, 1973.

Descriptors: \*Patents, \*Sewage treatment, \*Waste water treatment, \*Aeration, Aerobic treatment, Activated sludge, Bacteria, \*Reaeration, Water pollution control, Pollution abatement, Water quality control, Equipment, Treatment, \*Sludge treatment.

Partitions within the main container of this sewage treatment apparatus define aeration, stabilization and sedimentation chambers. A digestion cavity is placed beneath the stabilization chamber. Raw sewage is first directed into the aeration chamber. Settled sludge is drawn from the stabilization chamber and introduced into the aeration chamber. The sludge mixes with the sewage to cause the bacteriological conversion of solids into a liquid suspension of activated sludge flocs. The suspension is then directed into the sedimentation chamber to separate out the sludge from the liquid. The separated sludge is directed back into the stabilization chamber where a portion of it is returned to the aeration chamber and a portion settles into the digestion cavity. The aerated sewage is then led from the aeration chamber into the stabilization chamber to reaerate the sludge therein as well as the sludge which settled in the digestive cavity. The liquid remaining in the sedimentation chamber is directed out of the apparatus as ready for disposal or reuse. (Sinha-OEIS)

W74-00082

#### SELECTIVE DESTRUCTION OF BACTERIA, For primary bibliographic entry see Field 05F.

W74-00083

#### FILTER MEDIA FOR LIQUID WASTES TREATMENT AND METHOD OF FORMING THE SAME,

Del-Pak Media Corp., Oakland, Calif., (Assignee) E. R. Carlson.

U. S. Patent No. 3,750,887, 5 p, 5 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 913, No 1, p 187, August 7, 1973.

Descriptors: \*Patents, \*Liquid wastes, \*Waste water treatment, \*Filters, \*Filtration, Equipment, Separation techniques, Pollution abatement, Water pollution control, Water quality control, Biological treatment.

Pallet-like units are used as biological growth supporting surfaces. They are placed so as to form a self supporting stackable structure. The positioning of the supporting parts enables stacking of the units in vertically superimposed, horizontally extending layers with some of the horizontal units staggered or displaced so that units overlap each other and provide stability in the filter array. The pallet-like units may be formed of redwood, pressure treated wood, or a plastic material. (Sinha-OEIS)

W74-00091

#### ENGINEERING ALTERNATIVES IN NATURAL RESOURCES DEVELOPMENT IN URBAN REGIONS,

Philadelphia Water Dept., Pa.

S. S. Baxter.

In: National Conference on Urban Water Research, March 17-19, 1970, Keynote and Plenary Session Papers, p 19-23. (1970).

Descriptors: Sewerage, Sewage systems, Sewage disposal, Waste water treatment, Water quality, \*Regional development, \*Alternative planning, \*Water reuse, \*Recycling, \*Municipal water, Natural resources, Cities, Urbanization. Identifiers: Engineering alternatives.

Historically the waters of streams and rivers have been used to transport and dispose of waste material. In recent years there has been growing pressure to recycle this water and reuse it. In determining whether to treat the water so that it is fit for reuse in metropolitan areas several alternatives have traditionally been considered. Among these are going to an upland source of water in a more sparsely developed area and providing the water for the city by damming up smaller streams; making the most modern treatment plants so the river can continue to be used as the original source; and cleaning the rivers to such a degree they approximate the condition of the upland source. Recent developments have made other alternatives worth considering. One of these is regional treatment of water. Another is parallel supply systems, one containing water fit for human consumption, and the other containing water treated only to eliminate disease, which water is fit for industrial use, street washing, fire fighting, toilet flushing and other uses. These alternatives are analyzed. (See also W71-09468 and W71-09469) (Wadley-Florida)

W74-00122

#### PROCEEDINGS: LIVESTOCK WASTE MANAGEMENT RESEARCH REVIEW.

For primary bibliographic entry see Field 05G.

W74-00125

#### NATIONAL LIVESTOCK WASTE MANAGEMENT PROGRAM,

Agricultural Research Service, Beltsville, Md.

For primary bibliographic entry see Field 05G.

W74-00126

#### REGIONAL LIVESTOCK WASTE MANAGEMENT PROGRAM,

Nebraska Univ., Lincoln. Agricultural Experiment Station.

For primary bibliographic entry see Field 05G.

W74-00127

#### APPLICATION, UTILIZATION AND DISPOSAL OF LIVESTOCK WASTE,

Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 05G.

W74-00129

#### DESIGN AND MANAGEMENT OF RUNOFF CONTROL SYSTEMS,

Agricultural Research Service, Lincoln, Neb.

For primary bibliographic entry see Field 05G.

W74-00130

#### APPLICATION, UTILIZATION AND DISPOSAL OF LIVESTOCK WASTES,

Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 05G.

W74-00136

#### WASTE-INDUCED PROBLEMS OF HOUSED LIVESTOCK,

Agricultural Research Service, Clay Center, Nebr. Meat Animal Research Center.

For primary bibliographic entry see Field 05G.

W74-00139

#### OTHER RESEARCH NEEDS,

Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 05G.

W74-00140

#### PRESSURE SEWER DEMONSTRATION AT THE BOROUGH OF PHOENIXVILLE, PENNSYLVANIA,

General Electric Co., Philadelphia, Re-Entry and Environmental System Div.

G. Mekosh, and D. Ramos.

Copy available from GPO Sup Doc as EP1.23/2-73-270, \$1.00; microfiche from NTIS as PB-224 456, \$1.45. Environmental Protection Agency, Technology Series, EPA-R2-73-270, July 1973. 70 p, 13 fig, 10 tab. EPA Project 11050 FOU.

Descriptors: Water pollution control, \*Sewers, \*Sewage disposal, Plastic pipes, \*Pressure conduits, Data collections, Costs, \*Pennsylvania.

Identifiers: \*Pump-grinders, \*Pressure sewers, System monitoring, Cost breakdown, Wastewater characterization, \*Phoenixville (Penn).

A site was selected at the Borough of Phoenixville, Pennsylvania, which provided a maximum variable exercise of a pressure sewer system. The site consisted of five residences spread over more than one-half mile in hilly and predominantly shale-based terrain. The residences varied from a small house to a multiple-unit apartment house. The apartment house is more than half a mile in distance and 60 feet in elevation below the existing conventional gravity sewer inlet point. The project proved over a six-month period that a multiple residence pressure sewer system can adequately store peak loads of wastewater and grind and pump wastewater through small-diameter plastic pipe to the existing conventional gravity sewer. During the project, data was collected which provided information concerning the installation, operation and maintenance of the system, its technical performance, the variations in that performance during the six-month period and the characteristics of the wastewater as delivered to the existing gravity sewer. (Kreissl-EPA)

W74-00153

#### PHYSICAL-CHEMICAL TREATMENT OF A MUNICIPAL WASTEWATER USING POWDERED CARBON,

Envirotech Corp., Salt Lake City, Utah. Eimco Process Machinery Div.

D. E. Burns, and G. L. Shell.

Copy available from GPO Sup Doc as EP1.23/2-73-264, \$2.25; microfiche from NTIS as PB-244 494, \$1.45. Environmental Protection Agency, Technology Series Report EPA-R2-73-264, August 1973. 230 p, 59 fig, 35 tab, 37 ref. EPA Project 17020 EFB. Contract 14-12-585.

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

Descriptors: \*Waste water treatment, \*Adsorption, \*Coagulation, Activated carbon, Filtration, Solids contact process, Sludge treatment, Lime, Costs, Dewatering, Pilot plants, \*Utah.

Identifiers: \*Physical-Chemical treatment, \*Powdered carbon, \*Carbon regeneration, Alum, Ferric chloride, Sludge thickening, Sludge dewatering, \*Salt Lake City (Utah), Combined treatment.

A municipal waste water was treated in a nominal 100 gpm pilot plant by chemical coagulation-precipitation, powdered activated carbon adsorption and granular media filtration. Spent carbon was gravity thickened, vacuum filter dewatered and thermally regenerated in a fluidized bed furnace. Solids-contact units were used for chemical treatment and carbon contacting. Ferric chloride, alum or lime were all found to effectively produce coagulation and phosphorus insolubilization. Based on total treatment costs, including sludge disposal, alum treatment was estimated to be the economic choice for Salt Lake City municipal waste water. Organic removal in the powdered carbon contactors was substantially enhanced by anaerobic biological activity. The use of solids-contact treatment units for carbon contacting resulted in effecting gravity clarification without the use of chemicals. The powdered carbon physical-chemical treatment system produced a treated effluent similar to that expected for biological treatment followed by tertiary treatment for phosphorus removal. Carbon losses of 17 to 60 percent were experienced across the fluidized bed furnace regeneration system. The cause of high carbon losses was identified as ignition of carbon instead of gas which was injected into the fluidized bed to scavenge excess oxygen. (Kreissl-EPA) W74-00154

#### PILOT PLANT DEMONSTRATION OF LIME-BIOLOGICAL TREATMENT PHOSPHORUS REMOVAL METHOD, Kansas State Univ., Manhattan. Dept. of Civil Engineering.

L. Schmid.

Copy available from GPO Sup Doc as EP1.23/2:73-159, \$0.85; microfiche from NTIS as PB-224 476, \$1.45. Environmental Protection Agency, Technology Series, Report EPA-R2-73-159, June 1973, 48 p, 16 fig, 7 tab, 12 ref. EPA Project 17050 DCC.

Descriptors: \*Nutrient removal, \*Chemical coagulation, \*Biological treatment, Sludge, Municipal waters, \*Waste water treatment, Biological oxygen demand, Pilot plants, Instrumentation, Turbidity, \*Phosphorus, Lime.

Identifiers: Diurnal flow, Program controller, Respiration rate, Phosphate analyses, \*Lime treatment.

A 15,000 gpd pilot plant was constructed to demonstrate the capabilities of a lime treatment process for phosphorus removal. The lime treatment of raw waste water removes the bulk of the phosphorus, and subsequent biological process removes an additional increment of phosphorus via cell synthesis. The pilot plant used for the study was a package-type, prefabricated unit. Additional small tanks were provided for sludge storage and measurement. A variable speed motor was mated to a program controller to duplicate a diurnal flow pattern through the pilot plant. Lime was introduced into the raw waste water in response to an automated pH control system. Instrumented systems were also developed for turbidity and ortho-phosphate concentrations in the plant effluent. The raw waste water entering the pilot plant was obtained from the wet well of the Manhattan, Kansas Municipal Plant. Lime treatment of raw waste water to a pH of 9.5 to 10.0 resulted in phosphorus removal of about 80 percent in the primary clarifier. The removal of BOD at this pH level was about 60 percent as compared to 35 percent normally expected in primary settling. The biological activated sludge process following the lime treatment neutralized the prima-

ry effluent due to the microbial carbon dioxide production. Aerator pH's were in the neighborhood of 8.0. Lime treatment prior to biological treatment resulted in a change of the settleability of the mixed liquor. Rather high sludge volume indexes were routinely encountered. The process is capable of 90 percent phosphorus removal; however, consistent removal is only assured at the 80 percent level. (EPA) W74-00155

#### MUNICIPAL DESALTING STUDIES FOR SELECTED KANSAS COMMUNITIES, Wilson and Co., Salina, Kans.

For primary bibliographic entry see Field 05F. W74-00156

#### A PROMISING APPROACH TO SOLVING A STREAM POLLUTION PROBLEM, Calspan Corp., Buffalo, N.Y.

K. Wang, J. Schwartz, and B. T. Kown.

Technical paper, presented at the 18th Annual Meeting of the Institute of Environmental Sciences, New York, N.Y., May 4, 1972; 15 p, 1 fig, 7 tab, 8 ref.

Descriptors: \*Waste water treatment, Water quality, \*Water treatment, Filters, \*Recycling, Water pollution sources, Pilot plants, Sludge, \*Water reuse.

Identifiers: Alum sludge, Jar tests, \*Filter backwash water.

The backwash wastewater from a water purification plant has been classified as a potential pollutant and treatment is required before disposal. A promising approach to solving a stream pollution problem is to eliminate such waste discharge completely. The feasibility of direct recycling of filter backwash water was evaluated. The specific objectives were to determine the effects of the backwash recycle on the filter operation and the plant effluent quality. Preliminary laboratory studies were conducted using a series of standard jar tests. A continuous pilot plant of 1440 gal/day capacity was also constructed for a final phase feasibility study. Advantages of direct recycling of filter backwash water are a elimination of a stream pollution problem, the recovery and reuse of filter backwash water for water supply, and an increase in filter operation time. A water filtration plant, with recycling and reuse of its own filter backwash water, would materially reduce the volume of liquid waste. (Calspan) W74-00164

#### GLUE TREATMENT-PICK A WAY, Calspan Corp., Buffalo, N.Y.

L. K. Wang, P. Leonard, J. G. Michalovic, and D. W. Goupl.

Water and Wastes Engineering, Vol 10, No 9, p E20-E25, September 1973, 4 fig, 3 tab. 86-294.

Descriptors: \*Waste water treatment, \*Activated carbon, Chemical precipitation, \*Chromium, \*Recycling, Industrial wastes, Water pollution sources, Sludge, \*New York, Industrial water, Water reuse.

Identifiers: \*Glue factory wastes.

A typical animal-glue manufacturing plant in New York was selected for investigation. The animal-glue manufacturing procedures, the sources and characteristics of glue factory wastes, and the environmental pollution problems caused by the solid and liquid wastes are reviewed and studied. Four potential waste-treatment schemes which would solve the pollution problem or convert both solid and liquid wastes to useful by-products are also studied or assessed. The treated water can be recycled as industrial water. Chromium in the acid stream of glue factory waste can be recovered by chemical precipitation and incineration. Spent activated carbon can be regenerated for reuse. Or-

ganic waste sludge can be converted to powdered activated carbon by a Calspan-developed pyrolysis process. The sludge-generated carbon, in turn, can be used for wastewater treatment. (Calspan) W74-00165

#### ESTIMATING REGIONAL WASTEWATER TREATMENT COSTS, Wisconsin Dept. of Natural Resources, Madison. Water Resources Planning Section.

R. J. Timm, and J. M. Cain. Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 21 p, 2 fig, 2 tab, 9 ref.

Descriptors: \*Waste water treatment, \*Operating costs, \*Estimating, \*Pumping plants, Optimization, Computer models, Wisconsin, Systems analysis, Operation and maintenance, Construction costs, Regions, Statistical methods.

Identifiers: Regression equations, Standard deviations.

Regionalized sewage systems can reduce per capita sewage treatment costs providing proper regions are established. A computerized model has been developed to estimate costs of treatment systems for any specified region. Based on recent project costs, regression equations are developed to estimate interceptor and pumping station costs. Results of recently published studies are used to estimate initial construction costs and annual operating and maintenance costs of treatment plants. Standard deviations of all costs are calculated so that both an average cost and a cost confidence can be estimated. The model can be used to optimize costs of any given level of treatment. An example in central Wisconsin is presented to illustrate this use of the model. (Bell-Cornell) W74-00169

#### DESIGN OF OPTIMAL SEWERAGE SYSTEMS, Technion - Israel Inst. of Tech., Haifa.

Y. Argaman, U. Shamir, and E. Spivak.

Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 99, No E5, Proceedings paper No 10050, p 703-716, October 1973. 3 fig, 7 ref.

Descriptors: \*Sewers, \*Pipes, \*Design, \*Costs, \*Dynamic programming, Computers, Optimization, Environmental engineering, Sanitary engineering, Waste water disposal, Constraints, Hydraulics, Methodology.

Identifiers: \*Cost minimization, Network design, Sewerage networks, Pipe diameter, Pipes layout, Pipe slope.

The costs of sewerage systems constitute a major fraction of the overall cost of wastewater disposal. Thus, substantial sums of money can be saved by improving network design. Current design procedures involve selection of pipe sizes and slopes to ensure adequate capacity for peak flows and adequate scouring velocities at minimum or average flows, analysis of several alternative systems, and selection of the least-cost system. A procedure already developed for optimizing a sewer network is impractical at present due to limitations in computer space and computation time. An alternative, more restrictive, procedure is proposed by which a suboptimal design can be obtained with a reasonable computation effort. This procedure utilizes dynamic programming; its usefulness has been demonstrated for small sewerage networks. Large sewerage systems may be decomposed to smaller subsystems, which are optimized internally, and later recombined to a single optimal network. This work constitutes a step toward the development of a calculation technique by which the selection of the least-cost combination of pipes layout, diameters, and slopes can be made in a single computation procedure. (Bell-Cornell) W74-00183

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Waste Treatment Processes—Group 5D

**WATER QUALITY AND FISH LIFE BELOW SEWAGE OUTFALLS,**  
Maryland Univ., College Park. Natural Resources Inst.  
For primary bibliographic entry see Field 05C.  
W74-00248

**PILOT-DEMONSTRATION PROJECT FOR INDUSTRIAL REUSE OF RENOVATED MUNICIPAL WASTEWATER,**  
Central Contra Costa Sanitary District, Walnut Creek, Calif.

G. A. Horstak, Jr.

Copy available from GPO Sup Doc as EPI.23:670-73-064, \$1.55; microfiche from NTIS as PB-224 507, \$1.45. Environmental Protection Agency, Technology Series Report EPA-670/2-73-064, August 1973. 133 p, 26 fig, 21 tab, 12 ref. EPA Project 17080 FSF.

Descriptors: \*Water reuse, \*Reclaimed water, Sewage treatment, Tertiary treatment, \*Waste water treatment, \*Pilot plants, Municipal water, \*Cooling towers, \*Heat exchangers, Phosphorus, Corrosion, Fouling, Scaling.  
Identifiers: Canal water.

Three pilot plant treatment sequences were operated during this study to produce various grades of effluent for subsequent testing as industrial water sources. The testing was conducted in pilot-sized test loops consisting of small cooling towers and heat exchangers. At the same time the renovated waters were tested, Contra Costa Canal water, which is presently used by industry in the study area, was also investigated in a test-loop identical to those used for the renovated water. The study results illustrated that the wastewater investigated can be treated satisfactorily for reuse in industrial applications. Corrosion rates and fouling factors observed with renovated water were equal to or less than found with the canal water. Precipitation of phosphorus was the major source of scale formation while using renovated water for cooling purposes, thus indicating the need for phosphorus removal. (EPA)  
W74-00305

**RESEARCH ON REVERSE OSMOSIS MEMBRANES FOR PURIFICATION OF WASH WATER AT STERILIZATION (165 DEG F),**  
General Electric Co., Lynn, Mass.

J. M. Amore, J. F. Enos, and A. B. LaConti.  
Available from the National Technical Information Service as PB-222 950, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 866, February 1972. 71 p, 14 fig, 14 tab, 5 ref. 14-30-2752.

Descriptors: \*Membranes, \*Reverse osmosis, \*Membrane processes, Permeable membranes, Separation techniques, Semipermeable membranes, \*Waste water treatment.  
Identifiers: \*Sulfonated polyphenylene oxide membranes, Meniscus coating process, Ion exchange membranes, Composite films, Wash water, Synthetic wash water, Breadboard modules.

Reliable techniques were developed for meniscus coating sulfonated polyphenylene oxide membranes (PPO) of IEC  $\pm 1.3$  on Celgard 2400 to yield composite films approximately 2 ft long  $\times$  1 ft wide. A  $\text{CHCl}_3$ /butanol casting solvent was identified that yielded reproducible composite films with a sulfonated PPO membrane thickness of 0.05 to 0.1 mil. Reverse osmosis (RO) performance of the composite films was essentially equivalent to results achieved with knife-cast films of the same IEC. Aerospace-configured gasketed plate and frame RO hardware was designed and fabricated. The breadboard units employed thin channel labyrinth flow and series connected feed channels. A unique "composite gasket" screen configuration was developed that minimized probability of internal leakage during 165 deg F steady

state operation. Parametric life testing at 165 deg F was conducted with 2.5 gpd breadboard units with synthetic and real wash water. Results indicated that a one-pass system with inlet flow of 0.05 gpm may not be feasible because of concentration, polarization and projected fouling problems. The feasibility of developing a viable multipass plate and frame module was investigated. A feed flow rate of 0.15 gpm and average RO pressure of 600 psi were chosen as trade-off design points for life testing. Life tests revealed that at least 3 micron filtration of real wash water is required to minimize fouling (10 to 20%). It was demonstrated that original performance of a fouled membrane in a breadboard module can be essentially restored by treatment under operation with a 165 deg F caustic soap solution. Breadboard modules with 7.5 gpd capability were fabricated and briefly life tested. (OSW)  
W74-00316

**DEFINITION OF REVERSE OSMOSIS REQUIREMENTS FOR SPACECRAFT WASH WATER RECYCLING,**  
McDonnell Douglas Astronautics Co.-West, Huntington Beach, Calif.

D. F. Putnam, and G. W. Wells.

Available from the National Technical Information Service as PB-222 943, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 861, November 1972. 189 p, 41 fig, 23 tab, 35 ref. 14-30-3062.

Descriptors: \*Reverse osmosis, \*Membranes, Separation techniques, Membrane processes, Filtration, Permeability, Pressure, \*Recycling, \*Waste water treatment, Water quality standards.  
Identifiers: Wash water, Waste water, \*Wash water recovery, Space mission water requirements, Skylab, Multifiltration.

A six-man, reverse osmosis (RO) wash water recovery system that offers the dual advantages of lower equivalent weight and lower cost than competing wash water recovery techniques is defined and evaluated. The system meets the basic requirements of the advanced Skylab, the MDAC six-man modular space station, and the Space Station Prototype (SSP) program. Major design considerations include: Wash water requirements; Compatible cleansing agents; A theoretical estimate of the contaminants found in wash water, projected for the typical astronaut's work and exercise regimen as well as for a typical test subject; A standard procedure for producing used wash water similar to that projected for space vehicles; Wash water and potable water standards suggested by the National Academy of Sciences; A mass balance analysis and computer results that project concentrations of the major chemical contaminants expected in the reverse osmosis feed, product, and brine streams for various water recovery and solute rejection factors; A computerized parametric study of RO module sizing factors; Tradeoff studies comparing reverse osmosis to other methods of wash water recovery; and A detail design specification for a six-man RO unit for wash water recovery in a manned chamber test. (OSW)  
W74-00320

**FILTRABILITY OF WATER-TREATMENT-PLANT SLUDGE,**  
Auburn Univ., Ala. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 05F.  
W74-00387

**ANALYSIS OF ANIMAL WASTE STORAGE AND LAND DISPOSAL SYSTEMS,**  
Ohio State Univ., Columbus. Dept. of Agricultural Engineering.

R. A. Nordstedt.

PH D Dissertation, 1969. 101 p, 17 fig, 25 tab, 23 ref.

Descriptors: \*Farm wastes, Odor, \*Waste disposal, \*Waste storage, Air pollution, Livestock, \*Feed lots, Fertilizers, Nutrients, Nitrates, Effluents, Diffusion, \*Mathematical models.  
Identifiers: Scheduling model.

Systems which interact with storage and land disposal of farm wastes were analyzed and relevant interfaces and variables were identified. A mathematical model describing storage of wastes and their timely disposal on agriculture land was developed and tested. Odor nuisance potential of farm wastes spread on land was also delineated. A scheduling model was developed. It could be an effective tool in the design and operation of waste storage and land disposal systems. The model takes into account all important system variables. The waste storage facility was the most significant investment, based on results of the scheduling study. Nutrient effectiveness as a function of time and land availability were significant. The pattern of the latter was a critical factor in determining minimum storage capacity. (Frantz-East Central)  
W74-00393

**WATER POLLUTION BY SWINE PRODUCTION OPERATIONS,**  
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering.  
J. W. D. Robbins.  
PH D Dissertation 1970. 440 p, 51 fig, 48 tab, 57 ref.

Descriptors: Effluents, Waste disposal, Hydrographs, \*Hogs, \*North Carolina, Nutrients, \*Lagoons, Soils, Runoff, Influent, Bacteria, Surface waters, \*Water pollution, Drainage, Streams, \*Farm wastes, Hydrologic systems, Sampling, Biochemical oxygen demand, Nitrogen, Phosphates, Biodegradation.  
Identifiers: Organic carbon.

Seven swine production operations, three using lagoons, one direct discharge, two land disposal, and one control watershed were studied to determine the extent of effluent contribution to stream pollution. Data were collected to determine the effluent strength to be discharged into streams. An analysis was made for more than 1000 effluent and stream samples. An organic carbon analysis was successful in determining strengths of wastes and waste waters. The biochemical oxygen demand (BOD) total organic carbon (TOC) ratio provided an indication of the ease of biodegradation and/or the degree of stabilization. It was found that anaerobic lagoons are not satisfactory as the sole means of treating hog wastes. Direct discharge of wastes into water creates gross pollution and should be prohibited. Land disposal was the superior method for protecting water quality. Slope, degree of erosion, and drainage patterns are the important factors in determining the quality of streams draining agricultural basins. (Frantz-East Central)  
W74-00394

**ENGINEERING AGRICULTURAL WASTES,**  
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.  
B. J. Barfield, H. E. Hamilton, and I. J. Ross.  
In: Quality of the Environment, Socio-Economic, Biological and Engineering Aspects, Papers presented at the College of Agriculture Annual Conference, University of Kentucky, January 5-7, 1971. p 14-21 (1971), 3 fig.

Descriptors: Dehydration, Land use, Proteins, Erosion, Technology, \*Waste disposal, Lagoons, Kentucky, Insecticides, Odor, Livestock, Oxidation lagoons, \*Farm wastes, \*Air pollution, \*Water pollution, \*Soil contamination.  
Identifiers: Composting, Microbial disposal.

The extension of cities into farming areas, demands for more uniform quality products, increased farm production and increasing demands

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

for processed foods are among recent trends causing problems for agricultural waste management. Soil erosion accounts for approximately 88% and livestock wastes for 11% of all agricultural pollution. But the amount of livestock waste that must be handled by mass management methods is expected to double by 1980. Soil disposal and microbial disposal media are most common while composting and dehydration are also used. All agriculture waste problems must be met with technological, social, and economical acceptability. (Frantz-East Central)  
W74-00397

**COSTS FOR LARGE SCALE CONTINUOUS PYROLYSIS OF SOLID WASTES,**  
Texas Tech Univ., Lubbock. Dept. of Chemical Engineering.  
H. W. Parker, C. J. Albus, Jr., and G. L. Smith.  
Paper 43 b-rv, presented at the 74th National Meeting, American Institute of Chemical Engineers, New Orleans, March 12, 1973. 5 fig, 4 tab, 17 ref.

Descriptors: \*Solid wastes, \*Costs, Cattle, Feedlots, Waste disposal, \*Recycling, Electricity, \*Farm wastes, Gases, Fuels, Fertilizers, \*By-products, Sodium chloride, Pollution abatement. Identifiers: \*Pyrolysis, Municipal wastes, \*Retort, Char.

Conceptual process designs which utilize the recently developed TTU retort to pyrolyze 2,000 tons per day of either municipal solid waste or cattle feedlot waste are reported. The major product of these processes is the production of 30 megawatts of electricity. A governmental entity which could finance the required 15 million dollar investment with 6 per cent bonds over a 20 year period would have to charge users \$1.70 per ton of municipal refuse processed or \$0.70 per ton of feedlot waste pyrolyzed. (East Central)  
W74-00404

**CONTINUOUS SOLID WASTE RETORT - FEASIBILITY STUDY,**  
Texas Tech Univ., Lubbock. Dept. of Chemical Engineering.

J. R. Massie, Jr., and H. W. Parker.  
Paper No 43a presented to the 74th National Meeting of the American Institute of Chemical Engineers, New Orleans, March 12-15, 1973; 31 p, 12 fig, 6 ref.

Descriptors: \*Cattle, \*Farm wastes, \*Waste disposal, Recycling, \*Solid wastes, Oxidation, Temperature, Energy, By-products, Economics, Texas, Air pollution, Water pollution, Drying. Identifiers: \*Pyrolysis, \*Refuse retort, Municipal refuse, Agricultural crop wastes, Char product, Fuel.

Continuous pyrolysis of solid waste, cattle manure containing 30% moisture, was demonstrated in a six inch diameter retort at a mass flow rate of 136 lb/hr ft<sup>2</sup>. The retort was an open cylinder with a grate at the bottom. Cyclic injection of oxygen containing and oxygen free gas served to limit the heated zone of the retort to its midsection, which contained no mechanical parts. Maximum temperatures in the hot zone were controlled by mixing oxygen free gas with the injected air. This retort may also be used for municipal refuse, agricultural crop waste, or natural resources such as oil shale and coal. When integrated into a process, energy and by-products can be recovered from the retort as justified by economics, also air and water pollution problems can be easily controlled. (East Central)  
W74-00405

**CONVERSION OF URBAN REFUSE TO OIL,**  
Bureau of Mines, Pittsburgh, Pa. Pittsburgh Energy Research Center.  
H. R. Appell, I. Wender, and R. D. Miller.

Bureau of Mines Solid Waste Program, Technical Progress Report-25, May 1970. 5 p, 3 tab.

Descriptors: \*Recycling, Temperature, \*Sewage sludge, \*Oil, Water, Gas, Steam, Sulfur, Organic matter, \*Fuels. Identifiers: Processing, Furnace, \*Urban refuse, Cellulosic wastes, Carbon monoxide, \*Conversion.

Urban refuse, cellulosic wastes, and sewage sludge have been converted to heavy oil by heating under pressure with carbon monoxide and steam. Conversions of the organic matter to oil, water, and gas have averaged near 90 percent at temperatures of 250 deg to 400 deg C and pressures of 1,500 to 5,000 psi. The yield of oil, based on the dry organic matter of the waste materials, is usually near 40 percent. This is the equivalent of more than 2 barrels of oil per ton of dry, ash-free waste material. The oil from urban refuse and cellulosic wastes has a sulfur content near 0.1 percent. This low sulfur content makes the oil from refuse a desirable source of fuel oil. (East Central)  
W74-00406

#### **COUMAPHOS AS A FEED ADDITIVE FOR THE CONTROL OF HOUSE FLY LARVAE IN COW MANURE,**

Agricultural Research Service, Beltsville, Md.  
R. W. Miller, C. H. Gordon, N. O. Morgan, M. C. Bowman, and M. Beroza.  
Journal of Economic Entomology, Vol 63, No 3, p 853-855, June 1970. 3 tab, 14 ref.

Descriptors: \*Feeds, \*Additives, \*Cattle, \*Farm wastes, Dairy industry, \*Mortality, Milk, \*Insecticides, Larvae. Identifiers: \*Coumaphos, \*House flies, Musca domestica L.

The mortality of first-stage larvae of the house fly, *Musca domestica* L., seeded into the manure of dairy cows consuming O-144 ppm coumaphos in their ration increased as the concentration of coumaphos in the ration was increased. At the 144 ppm level, larval mortality approached 100%. Although coumaphos residues were found in the feces no residues (<0.002 ppm) appeared in the milk of cows at any level of coumaphos fed. Neither feed intake nor milk production was affected by the feeding of coumaphos. The blood cholinesterase of 1 cow fed 150 ppm coumaphos over a 6-week period dropped to 20% of pre-experimental levels. (East Central)  
W74-00411

#### **A RECYCLED FEED SOURCE FROM AEROBICALLY PROCESSED SWINE WASTES,** Illinois Univ., Urbana. Dept. of Agricultural Engineering.

D. L. Day, and B. G. Harmon.  
Paper No 72-954 presented at 1972 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 11-15, 1972. 10 p, 5 fig, 7 tab, 21 ref.

Descriptors: \*Recycling, \*Feeds, \*Swine, \*Farm wastes, Aerobic conditions, Water, Nutrients, \*Oxidation lagoons, Proteins. Identifiers: Odor control, Rats, \*Waste management.

An intriguing amount of protein was noticed in swine oxidation ditch mixed liquor at the University of Illinois in 1967. Studies have been in progress since then to measure the nutritive value of the aerobically processed product and use it as a feed supplement in feeding trials to rats and hogs. Several methods of concentrating and feeding the product have been tried. Utilizing this product provides a source of water and nutrients for swine while minimizing environmental pollutants (air, water, soil). There is odor control and little if any effluent from the building. The results have been very favorable and economics appear competitive

with other methods of waste management with a high degree of pollution control. (East Central)  
W74-00412

#### **NEW FEEDLOT CONCEPT USES CONVERTED MANURE AS FEED,** T. Zurowski.

Feedlot Management, Vol 15, No 8, p 26, Aug. 1973. 1 fig.

Descriptors: \*Recycling, \*Farm wastes, \*Cattle, \*Feed lots, \*Nutrients, \*Feeds, Economics, Bacteriology.

Identifiers: \*Refeeding, Cowmel, Farm Ecology Company, Food and Drug Administration, \*Cowdominium.

A Washington operation, Farm Ecology, has made plans for a cowdominium. This is a feed storage and a waste conversion plant. There the wastes are subjected to heat, pressure and either acidic or alkaline chemicals. The recycled product, Cowmel, is a highly nutritious and finely ground pellet. Economic feasibility and FDA approval is presently uncertain. (Frantz-East Central)  
W74-00415

#### **A COMPARISON OF THREE SYSTEMS FOR TRANSPORT AND TREATMENT OF SWINE MANURE,** Iowa State Univ., Ames. Dept. of Agricultural Engineering.

H. L. Person, J. R. Miner, T. E. Hazen, and A. R. Mann.  
Paper No 72-439 presented at the 1972 Annual Meeting, American Society of Agricultural Engineers, Hot Springs, Arkansas, June 27-30, 1972. 30 p, 2 tab, 8 fig, 6 ref.

Descriptors: \*Hogs, \*Waste treatment, \*Farm wastes, Feed lots, Iowa, Aerated lagoons, \*Oxidation lagoons, Effluent, Nutrients, Bacteria, Fungi, Slime, Odor, Pumping, Maintenance, Water quality.

Identifiers: \*Waste transport, Waste management systems, Rotating biological contactor, Flushing gutter, Hydraulic cleaning.

Four engineers have demonstrated and evaluated three systems for hydraulic transportation and disposal of manure. The aeration basin, lagoon aeration basin, and rotating biological contactor systems all successfully used treated effluent as a cleaning medium in swine farrowing and finishing buildings. Aeration basins treated liquid manure. Pumping was done economically and excess water proved virtually odorless. The process didn't add significantly to either water pollution or animal health problems. Systems and equipment are described in detail. (Frantz-East Central)  
W74-00416

#### **HIGH-TEMPERATURE, HIGH-PRESSURE EXTRUSION OF CHICKEN EXCRETA,** Kentucky Univ., Lexington. Dept. of Agricultural Engineering.

F. A. Payne, I. J. Ross, H. E. Hamilton, and J. D. Fox.

Paper No. 72-450 presented at the 1972 Annual Meeting, American Society of Agricultural Engineers, Hot Springs, Arkansas, June 27-30, 1972. 22 p, 6 fig, 1 tab, 17 ref.

Descriptors: \*Farm wastes, \*Poultry, \*Waste treatment, \*Recycling, \*Temperature, \*Pressure, Moisture content.

Identifiers: \*Extrusion, Thermal destruction, Uric acid, Chemical changes, Physical changes, Sterilization, Flash volatilization, Microbial organisms.

Chicken excreta and an excreta-feed mixture were extruded at a temperature range of 250-300F. for periods of 8.6 to 21.4 seconds. Pressures of 300 to

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Waste Treatment Processes—Group 5D

600 psi were utilized with the high temperatures to aid in microbial destruction. An analysis includes chemical and physical changes in the extended material. Also given is an equation which can be used to predict microbial destruction. When extruded, chicken manure (which normally contains disease organisms) may become a versatile, low-cost, and highly productive food material. (Frantz-East Central)

W74-00418

#### **HUMAN AND ANIMAL WASTES AS FERTILIZERS,**

Metropolitan Sanitary District of Greater Chicago, Ill.

J. R. Peterson, T. M. McCalla, and G. E. Smith. In: *Fertilizer Technology and Use*, 2nd edition, Soil Science Society of America, p 557-596, 1971. 8 fig, 27 tab, 42 ref.

Descriptors: \*Farm wastes, \*Sewage, \*Waste disposal, Irrigation, Nitrates, Soil profiles, Lagoons, Pathogenic bacteria, \*Fertilizers, \*Water pollution, \*Soil contamination, Odor, Leaching, Chemical properties, Physical properties, Microbial composition, Crops, Toxicity. Identifiers: \*Human wastes, Plant yields, Digested sludge.

Solid waste from municipal wastewater treatment plants in the United States is analyzed quantitatively and qualitatively. If properly digested, the sludge has little odor and is relatively free of pathogens. The use of digested sludge to ameliorate soils has been proven. Three years' use of digested sludge on corn land has resulted in increased grain yields with no visual toxic symptoms to the plants. Qualitative and quantitative studies were also made on animal wastes. Although most pathogens are generally destroyed in the holding of wastes, weed infestations may be a problem with the application of animal waste to soil. Specific instances of waste utilization for soil improvement are cited for various states. (Wetherill-East Central)

W74-00419

#### **CONTINUED RECYCLING OF CATTLE MANURE,**

California Univ., Davis.

C. L. Ferrell, and W. N. Garrett.

Proceedings, Western Section, American Society of Animal Science, Vol 24, p 415-419, 1973. 5 tab, 5 ref.

Descriptors: \*Cattle, \*Farm wastes, \*Recycling, Nitrogen, Calcium, Nutrient requirements, \*Waste disposal, California.

Identifiers: Ration, Digestion stalls, Forced-air ovens, Digestibility.

Four Hereford steers were confined in digestion stalls and fed the basal ration at a maintenance level. Their manure and urine were recycled in forced air ovens at 100°C. for 48 hours. The recycled wastes were mixed 50:50 with the basal ration. Resulting wastes were similarly treated and mixed, digested, then recycled again. The less digestible components of the feces increased while digestible components decreased substantially during each recycling. Less energy was digested in subsequent refeeding. Mineral and nitrogen content increased with each recycling, resulting in the only significant nutritional value of manure after recycling. (Frantz-East Central)

W74-00424

#### **ELECTRIC IN-HOUSE DRYING OF POULTRY WASTE,**

Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.

D. R. Price, A. T. Sobel, and H. R. Davis. Paper No 72-806 presented at the 1972 Winter Meeting of the American Society of Agricultural

Engineers, Chicago, Illinois, December 11-15, 1972. 12 p, 9 fig, 3 tab.

W74-00429

Descriptors: \*Poultry, Odor, Nutrients, \*Recycling, \*Farm wastes, Physical properties, Moisture, Fertilizers, \*Waste disposal, New York, \*Drying.

Identifiers: In-house drying, High-rise poultry house, Circulating fans, Exhaust fans, Drying costs.

Forced air over manure removes water continuously in a high rise poultry house designed to house 30,000 caged birds. The drying process removes one-half of the wastes' total weight and reduces odor by minimizing bacterial activity. The dried manure is spread only once a year, thus recycling nutrients through cropland. Design figures for a high-rise poultry house and operation costs for the drying system are included. (Frantz-East Central)

W74-00426

#### **EFFECTS OF SWINE LAGOON EFFLUENT ON THE SOIL AND PLANT TISSUE,**

Iowa State Univ., Ames. Dept. of Agricultural Engineering.

C. V. Booram, T. E. Hazen, and L. R. Frederick. Paper No 73-239 presented at 1973 Annual Meeting, American Society of Agricultural Engineers, University of Kentucky, Lexington, Kentucky, June 17-20 1973. 19 p, 17 tab, 1 fig, 16 ref.

Descriptors: \*Hogs, Cattle, Iowa, \*Farm wastes, Confinement pens, \*Lagoons, Anaerobic conditions, \*Effluents, \*Nutrients, Electrical conductance, Salts, \*Waste disposal, \*Irrigation, \*Toxicity, \*Water pollution, Corn (Field), \*Soil contamination, Water quality. Identifiers: Clarion-Webster soil, Tile-drained grass plots, Plant tissues.

Twelve 40 x 60 foot tile drained plots of Clarion-Webster soil were given applications of anaerobic lagoon effluent. The soil received 0, 3.7, 11.3, and 22.6 inches of effluent per season. There were no significant plant population differences at the 0.10 level. Corn tissues were analyzed for 14 nutrients. (N, P, K, Mg, Ca, Na, Si, Mn, Fe, Cu, Zn, Al, Sr, and Mo). In the tissue analysis, P, Na, Fe and Al increased while Mg content decreased with increasing applications of effluent. After 4 years of anaerobic lagoon effluent applications the electrical conductivity of the soil showed little change. (Frantz-East Central)

W74-00428

#### **RECOVERY OF ANIMAL FEED FROM CATTLE MANURE,**

Agricultural Research Service, Peoria, Ill. Northern Marketing and Nutrition Research Div.

R. W. Jones, J. H. Sloncker, and G. E. Inglett. In: *Proceedings 18th Annual Institute of Environmental Sciences*, (1971), p 267-269, 3 tab, 17 ref.

Descriptors: \*Recycling, \*Farm wastes, \*Cattle, \*Feed lots, Waste disposal, Amino acids, Proteins, Filtration, Centrifugation, Illinois. Identifiers: Fractionating.

In the United States over 10 million tons of high grade protein are produced annually in cattle manure. Separating useful feed from fecal waste has become a valuable process which lowers feed costs and aids in waste disposal. Four methods for fractionating manure to remove undesirable constituents to produce high-protein feed supplement are described. Manure may be refined to remove the residue fraction, yielding a soluble fraction and a feed fraction that contains 64% of the original nitrogen. The feed fraction is higher in amino acid content than corn or wheat. The average steer annually produces \$34 to \$59 worth of feed fraction. Feed savings alone could be used to properly dispose of less usable waste fractions. (Frantz-East Central)

PERIODICITY OF THE BLUE-GREEN ALGAE AND THEIR EFFECT ON THE EFFICIENCY OF MANURE-DISPOSAL LAGOONS,

Agricultural Research Service, Washington, D.C. Agricultural Engineering Research Div.

H. J. Eby, and V. P. Singh.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price \$0.15. Production Research Report No 142, April, 1972. 8 p, 2 fig, 2 tab.

Descriptors: \*Recycling, Nutrients, Waste water, \*Lagoons, \*Algae, Bacteria, \*Sewage, Oxidation, Climatic zones, Proteins, Farm wastes, \*Waste water treatment, \*Nutrient removal, \*Cyanophyta.

Identifiers: \*India, Waste disposal lagoons, Seasonal growth.

This research provided a starting point for expanding feed production and aiding in the biological purification of waste water. Research in India revealed that blue-green algae have self-limiting tendencies and may be used advantageously. Since growth periods in the species vary, scientists might possibly anticipate each species' population peaks thereby controlling algae growth. Harvesting of algae serves two purposes: (1) to remove organic matter thus preventing it from becoming a pollutant, and (2) to serve as potential livestock and poultry feed. (Frantz-East Central)

W74-00430

#### **METHODS FOR IMPROVEMENT OF TRICKLING FILTER PLANT PERFORMANCE. PART I. MECHANICAL AND BIOLOGICAL OPTIMA,**

North Carolina Univ., Chapel Hill. Wastewater Research Center.

James C. Brown, L. W. Little, D. E. Francisco, and J. C. Lamb.

Copy available from GPO Sup Doc as EP1.23-670-73-047a, \$2.30; microfiche from NTIS as PB-224 787, \$1.45. Environmental Protection Agency, Technology Series Report EPA-670/2-73-047a, August 1973. 235 p, 37 fig, 28 tab, 58 ref. EPA Project 11010 DGA, Contract 14-12-505.

Descriptors: \*Waste water treatment, \*Trickling filters, \*Performance, Optimization, \*Operations, \*Pilot plants, Filtration, Biochemical oxygen demand, Treatment facilities.

Identifiers: \*Hydraulic surface loading, Nitrogenous oxygen demand.

The Chapel Hill high rate trickling filter plant which consists of two parallel and equal lines of treatment units was operated in parallel as two separate plants over a period of 26 months. Each side was operated with various fractions of influent flow and recirculation flow rates. Statistical analysis of operating results indicated that the common mathematical models are not reliable in predicting daily performance at the Chapel Hill plant. They are, however, useful in predicting long term average performance. Recirculation ratios as high as 3.0 proved beneficial at total hydraulic loadings of less than 20 mgad. Operation above this loading is not currently feasible at Chapel Hill. The hydraulic surface loading of the final settling tanks was found to have a significant effect on overall plant performance. A surface loading of 500 gpd/sq ft is recommended for the design of final tanks in new plants. Pilot plant studies using 4-foot diameter rock filters indicate a significant advantage for two-stage filtration even though the hydraulic loading on each stage may be double that for single-stage operation. Pilot plant studies of activated sludge treatment of trickling filter effluents were conducted. The process proved effective in improving removal of BOD, if effective final solids removal facilities are provided. The process also proved effective in reducing nitrogenous oxygen demand. (EPA)

W74-00431

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

**INDIVIDUAL HOME AEROBIC WASTEWATER TREATMENT SYSTEMS,** Colorado Univ., Boulder. Dept. of Civil and Environmental Engineering. E. R. Bennett, K. D. Linstedt, and R. N. McBride. Trans. available from University of Kansas, Lawrence 66044, Price: \$5.00. In: Transactions of the Twenty-third Annual Conference on Sanitary Engineering presented by School of Engineering and Conference and Institutes. Division of Continuing Education, University of Kansas, are presented February 7, 1973, p 71-96. (1973). OWRR A-021-COLO (1).

Descriptors: \*Septic tanks, \*Aerobic treatment, \*Colorado, Operations, \*Waste water treatment, Costs, \*Equipment, \*Waste water disposal, Performance, Treatment facilities.

Identifiers: \*Evaporation-transpiration beds.

Descriptions are presented of the major types of equipment used in individual home wastewater disposal systems in Colorado. Comparisons of operation, cost and effluent quality for septic and aerobic systems and a few details on evaporation-transpiration beds are included.

W74-00434

**REPORT TO THE GOVERNOR AND THE INTERIM FINANCE COMMITTEE: ALTERNATIVE RECOMMENDATION, LAS VEGAS WASH/BAY POLLUTION ABATEMENT PROJECT.**

Clark County Board of County Commissioners, Nev.

September, 1973. 7 p, 2 fig.

Descriptors: \*Waste water treatment, \*Pollution abatement, \*Nevada, Water reuse, Colorado River.

Identifiers: \*Waste water reclamation, \*Las Vegas (Nev).

Pursuant to Nevada statute recognizing Clark County as the instrument of government responsible for development and implementation of a pollution abatement plan for the Las Vegas Wash-Lake Mead area, the Board of County Commissioners recommends that an alternative be developed for the plan proposed by the Las Vegas Valley Water District. Reclamation of wastewater, in-valley irrigation, power and industrial uses, and possible future groundwater recharge will be emphasized in the forthcoming recommended plan, whereas export of wastewater was emphasized by the Water District's earlier plan. Selected staff, contractual rights, and obligations of the Las Vegas Valley Water District have been transferred to Clark County in order to insure orderly transfer of pollution abatement project responsibility. A program outline developing and recommending water standards, evaluating methods and costs of meeting those standards, and developing uses for reclaimed wastewater, 'Advanced Wastewater Treatment of Effluents from the City of Las Vegas and Clark County Sanitation District Wastewater Treatment Plants,' has been prepared. The County Commissioners have indicated an intent to plan, design, and construct facilities necessary to implement the wastewater management plan with consultation from Burrows, Smith and Company of Salt Lake City. Committees will be established to explore possible contracts with the Nevada Power Company or others wishing to acquire secondary water rights and to determine community desires for recreational use of Las Vegas Wash. A timetable for pollution abatement project actions from July, 1973 through July, 1974 is presented. (Stein-North Carolina)

W74-00440

### METROPOLITAN COUNCIL FIVE-YEAR CAPITAL IMPROVEMENT PROGRAM FOR SEWERAGE FACILITIES.

Metropolitan Council of the Twin Cities Areas, Minn.

For primary bibliographic entry see Field 05G.

W74-00450

### SEWAGE AND WASTE CONTROL RULES AND REGULATIONS FOR THE METROPOLITAN DISPOSAL SYSTEM.

Metropolitan Sewer Board, St. Paul, Minn.

For primary bibliographic entry see Field 05G.

W74-00452

### WATER QUALITY PROGRAM FOR OAHU WITH SPECIAL EMPHASIS ON WASTE DISPOSAL: FINAL REPORT.

Engineering-Science, Inc., Honolulu, Hawaii; Dillingham Environmental Co., Honolulu, Hawaii; and Sunn, Low, Tom and Hara, Inc., Honolulu, Hawaii.

Prepared for City and County of Honolulu, Department of Public Works, February, 1972. 336 p, 36 fig, 89 tab, 35 ref.

Descriptors: \*Waste water disposal, \*Waste water treatment, \*Hawaii, \*Oahu, \*Honolulu, Sewage disposal, Runoff, Water reuse, \*Water quality standards, Oceanography, Costs, Financing.

Identifiers: Waste loads.

A consortium of three firms allocated components of this detailed wastewater disposal study among themselves. Wastewater generation on Oahu in 1972 was estimated to be 109 mgd and is projected to increase to about 265 mgd by 2020 due to population increases. About half the 1970 discharge received no treatment, resulting in deterioration of water quality. Special emphasis is given to wastewater disposal problems in Māmala Bay (off Honolulu's Sand Island treatment plant), Pearl Harbor, and Kaneohe Bay. Water quality objectives set by the State Water Quality Standards were reviewed and quantified when appropriate. The design of water quality control systems is directed toward conservation of corals and other aquatic organisms, protection of aesthetic qualities, and protection of recreational uses of waters. Two fundamental objectives are minimization of deleterious discharges and minimization of concentrations of deleterious discharges which cannot be avoided. Advanced primary treatment and discharge via a 300-foot-deep ocean outfall was recommended for the Sand Island treatment facility. Secondary treatment and reuse of water for sugar cane irrigation was recommended for the Pearl Harbor area. Upgrading of existing facilities and discharge via a deep ocean outfall off Mokapu point was recommended at Kaneohe Bay. Recommendations are made for wastewater collection, treatment, and disposal in other wastewater systems. Construction costs of \$277 million current dollars and a 50-year phasing program are considered. Specific recommendations are made for future studies. (Stein-North Carolina)

W74-00456

### CENTRAL FRESNO COUNTY WATER AND LIQUID WASTE PROGRAM: VOLUME I—FINDINGS, CONCLUSIONS, RECOMMENDATIONS.

Grunwald, Crawford and Associates, Inc., Fresno, Calif; and Engineering-Science, Inc., Fresno, Calif.

For primary bibliographic entry see Field 03D.

W74-00457

### DESMIDIACEAE OF WASTE WATERS, (IN RUSSIAN),

Kharkov State Univ. (USSR).

T. V. Dogadina.

Biol Nauki. Vol 15, No 7, p 76-81. 1972.

Identifiers: Chemistry, \*Desmidaceae, Morphology, \*Waste water treatment, Treatment ponds, Algae.

Eleven species and 1 form of Desmidaceae were encountered in water treatment ponds. A list of the algae with an indication of some morphological features, type of pond, and chemical composition of the water is given. The indicator value of 2 spp. is suggested.—Copyright 1973, Biological Abstracts, Inc.

W74-00485

## 5E. Ultimate Disposal of Wastes

### COST-EFFECTIVENESS ANALYSIS OF DISPOSAL SYSTEMS,

M. L. Popovich, L. Duckstein, and C. C. Kisiel.

Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 99, No 6E3, Proceedings paper No 10104, p 577-591, October 1973. 2 tab, 25 ref.

Descriptors: \*Waste disposal, \*Water pollution, \*Environmental engineering, \*Solid wastes, \*Incineration, \*Alternative planning, Groundwater, Natural resources, Byproducts, Utilities, Evaluation, Decision making, Systems analysis, \*Arizona.

Identifiers: \*Cost-effectiveness, \*Tucson (Ariz), Sanitary landfill, Sensitivity analysis.

A technique is proposed for evaluating alternative waste disposal methods in order to choose the one that will best meet a community's requirements. Using Kazanowski's standardized cost-effectiveness methodology, alternative systems are compared for effectively disposing 4 lbs to 5 lbs of municipal refuse per person per day in urban communities of the United States. The criteria for studying this problem are often limited to cost or marketable measures; in contrast, use of a cost-effectiveness approach allows the inclusion of nonquantifiable measures of effectiveness such as public acceptance, political factors, health risks, environmental constraints, soil benefits, and potential groundwater pollution. Data from a case study in Tucson, Arizona are used to illustrate the problem and methodology. The use of sensitivity analysis for evaluating uncertain factors is discussed. The three main areas of uncertainty in the application of the methodology are: (1) Determination of goals; (2) identification of criteria; and (3) determination of the capabilities of each alternative system in terms of the criteria chosen. (Bell-Cornell)

W74-00484

### ANALYSIS OF ANIMAL WASTE STORAGE AND LAND DISPOSAL SYSTEMS,

Ohio State Univ., Columbus. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 05D.

W74-00393

### ENGINEERING AGRICULTURAL WASTES,

Kentucky Univ., Lexington. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 05D.

W74-00397

### COSTS FOR LARGE SCALE CONTINUOUS PYROLYSIS OF SOLID WASTES,

Texas Tech Univ., Lubbock. Dept. of Chemical Engineering.

For primary bibliographic entry see Field 05D.

W74-00404

### CONVERSION OF URBAN REFUSE TO OIL,

Bureau of Mines, Pittsburgh, Pa. Pittsburgh Energy Research Center.

For primary bibliographic entry see Field 05D.

W74-00406

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Water Treatment and Quality Alteration—Group 5F

**A RECYCLED FEED SOURCE FROM AEROBICALLY PROCESSED SWINE WASTES,**  
Illinois Univ., Urbana. Dept. of Agricultural Engineering.  
For primary bibliographic entry see Field 05D.  
W74-00412

**RECOVERY OF ANIMAL FEED FROM CATTLE MANURE,**  
Agricultural Research Service, Peoria, Ill. Northern Marketing and Nutrition Research Div.  
For primary bibliographic entry see Field 05D.  
W74-00429

**SOLID WASTE MANAGEMENT.**  
Metropolitan Council of the Twin Cities Area, Minn.  
For primary bibliographic entry see Field 05G.  
W74-00449

**WATER QUALITY PROGRAM FOR OAHU WITH SPECIAL EMPHASIS ON WASTE DISPOSAL: FINAL REPORT.**  
Engineering-Science, Inc., Honolulu, Hawaii; Dillingham Environmental Co., Honolulu, Hawaii; and Sunn, Low, Tom and Hara, Inc., Honolulu, Hawaii.  
For primary bibliographic entry see Field 05D.  
W74-00456

### 5F. Water Treatment and Quality Alteration

**SELECTIVE DESTRUCTION OF BACTERIA,**  
R. R. Meyers.  
U. S. Patent No. 3,753,886, 3 p, 3 fig, 13 ref; Official Gazette of the United States Patent Office, Vol 913, No 3, p 945, August 21, 1973.

Descriptors: \*Patents, \*Waste water treatment, Liquid wastes, \*Bacteria, Electricity, \*Water purification, Water quality control, Treatment, \*Water treatment, \*Electrolysis.

This water purification treatment consists of selective killing of certain bacteria. The liquid is deposited within a container and an approximately 60 c.p.s. alternating electrical current of 2-8 amperes at 7-28 volts is passed through the liquid. The muscles of the bacteria are vibrated until death results. With the use of alternating current, no metal hydroxide is produced at least at 60 c.p.s. or higher. (Sinha-OEIS)  
W74-00083

**EFFECTS OF WATERSHED DEVELOPMENT ON WATER QUALITY,**  
Tennessee Valley Authority, Chattanooga. Water Quality Branch.  
For primary bibliographic entry see Field 05C.  
W74-00118

**TASTE THRESHOLDS OF HALOGENS IN WATER,**  
Environmental Protection Agency, Boston, Mass. P. Bryan, L. Kuzminski, F. Sawyer, and T. H. Feng.  
Journal of American Water Works Association, Vol 65, No 5, p 363-368, May 1973. 3 fig, 2 tab, 32 ref.

Descriptors: \*Taste, \*Water quality, \*Water analysis, \*Halogens, Bromine, Chlorine, Iodine, Chlorination, Laboratory tests, Measurement, Testing procedures, Disinfection, Water purification, Chemical properties, Potable water, Con- sumptive use.

The group of chemical compounds referred to as the halogens are effective water disinfecting agents, but when applied in sufficient concentra-

tion, they may lend an unpleasant taste and odor to water supplies. Perception of taste is a very individualized characteristic among humans, with some persons able to detect much smaller concentrations of chemicals than other people can notice. The tests described used a panel of eleven persons of both sexes and ranging in age from their early twenties to their mid-fifties. The testing consisted of tasting three samples of water, one of which contained a known concentration of the halogen compound and the other two were reagent water which had been distilled, demineralized and deodorized. The test results indicated that with chlorine residuals, taste threshold values varied quite significantly with pH, while for bromine and iodine there was no significant variation at different pH levels. (McKnight-Florida)  
W74-00119

**ENGINEERING ALTERNATIVES IN NATURAL RESOURCES DEVELOPMENT IN URBAN REGIONS,**  
Philadelphia Water Dept., Pa.  
For primary bibliographic entry see Field 05D.  
W74-00122

**MUNICIPAL DESALTING STUDIES FOR SELECTED KANSAS COMMUNITIES,**  
Wilson and Co., Salina, Kans.  
R. E. Crawford, R. P. Selm, G. D. Starrett, and C. A. Roberts.  
Available from the National Technical Information Service as PB-222 942, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No 869, March 1973. 209 p. 14-30-2738.

Descriptors: \*Desalination, \*Water reuse, Economics, Cost analysis, \*Kansas, \*Water softening, Brackish water, Potable water, Water treatment.

This is a summary report of municipal desalting studies for selected Kansas communities and a waste water reuse study utilizing desalting processes for Wichita, Kansas. The report includes a preliminary engineering and economic assessment of the feasibility and cost of applying various desalting techniques to improve the quality of potable water at Arkansas City, Damar, Girard, Hillsboro, Larned, Potwin, Towanda and a regional plan which included Potwin and Towanda. Total treatment systems were analyzed including optimization of pretreatment systems (sequestration, lime treatment, and lime-soda softening); application of six desalting techniques; and utilization of subsurface injection of brines (a Kansas regulatory requirement). Special consideration was given to protecting process equipment and subsurface brine receiving formations against calcium sulfate precipitation. The total treatment costs include supply, pretreatment, desalting, brine disposal, and delivered water facilities and ranged from a low of 47.2 cents/kgal to supply a peak demand of 5.0 MGD at Arkansas City to a high of 685.5 cents/kgal to supply a peak demand of 0.1 MGD at Damar. A special study was made at Wichita, Kansas wherein waste water from the City's secondary treatment facilities was returned for reuse after additional treatment which included lime treatment, ammonia stripping, filtration, carbon adsorption, chlorination, 30-day detention and desalting at a cost of 80.9 cents/kgal for a continuous demand of 10-20 MGD. (OSW)  
W74-00156

**A PROMISING APPROACH TO SOLVING A STREAM POLLUTION PROBLEM,**  
Calspan Corp., Buffalo, N.Y.  
For primary bibliographic entry see Field 05D.  
W74-00164

**FABRICATION AND TESTING OF TUBULAR REVERSE OSMOSIS MODULES CONTAINING ULTRATHIN MEMBRANES FOR WET-DRY CYCLING OPERATIONS,**  
North Star Research and Development Inst., Minneapolis, Minn.

J. E. Cadotte, K. E. Cobian, and L. T. Rozelle. Available from the National Technical Information Service as PB-223 137, \$1.45 in microfiche. Office of Saline Water Research and Development Progress Report No. 874, June 1973. 25 p, 2 fig, 6 tab, 5 ref. 14-30-2883.

Descriptors: \*Membranes, \*Reverse osmosis, Permeability, Separation techniques, Membrane processes, Brackish water, Thin films, Water purification, Water quality, Water treatment.

Identifiers: Ultrathin membranes, Cellulose acetate, Tubular membranes, Porous substrate.

The objective was to apply ultrathin reverse osmosis membranes to wet-dry cycling conditions with acceptable reverse osmosis performance. In the first phase the composite system of ultrathin cellulose acetate membranes on microporous polysulfone support films in 1/2-inch fiber glass tubes was shown to meet the specifications provided by the U.S. Army Mobility Equipment Research and Development Command. However, the adhesion of the ultrathin membrane to the polysulfone support was not strong enough to withstand high turbulence during filling of the modules. The objective of the second phase was to find a proper adhesive system for this composite membrane system to resist extreme flushing conditions while maintaining adequate flux, rejection, and wet-dry properties. An adhesive system including glyoxal in the Reten solution and 2,4-diamino-6-phenyl-s-triazine (DPT) in the polysulfone liner was developed that looked promising in two-foot tubes. However, DPT was detrimental to the membrane in five-foot tubes (for the modules). It was found at the end of the program that DPT could be eliminated in another procedure used for producing a wet-dry membrane. After flushing tests in flat cells the membrane composites exhibited fluxes of 36 to 42 gfd and rejections of 91 to 94 percent (600 psi, 0.5 percent NaCl, and 25 deg C). (OSW)  
W74-00313

**FILTRABILITY OF WATER-TREATMENT-PLANT SLUDGE,**  
Auburn Univ., Ala. Dept. of Civil Engineering.  
R. W. Glenn, J. F. Judkins, Jr., and J. M. Morgan. Journal American Water Works Association, Vol 65, No 6, p 414-417, June 1973. 3 fig, 24 ref. OWRR A-024-ALA (4).

Descriptors: \*Water treatment, Sludge, \*Filtration, \*Sludge treatment, Sulfates, Waste water treatment, \*Coagulation.  
Identifiers: \*Alum sludge, Aluminum sulfate.

The use of aluminum sulfate (alum) as a coagulant for treating surface-water supplies was introduced in 1884. Since that time, the disposal of filter-backwash wastes and coagulant sludges has, in most cases, been accomplished by direct discharge to receiving streams. Under current guidelines, however, the sludge must be treated as a concentrated pollutant. The filtration possibilities of alum and some interesting new observations are discussed.  
W74-00387

**ON THE PROBLEM OF EMERGENCY-SUPPLY WITH DRINKING-WATER BY WAY OF SEITZ-FILTER, (IN GERMAN),**  
Mainz Univ. (West Germany). Hygiene Institut. A. Hechmat. Zentralbl Bakteriol Parasitenkd Infektionskr Hyg Erste Abt Orig Reihe B Hyg Praev Med. Vol 155, No 5/6, p 535-540. 1972. (English summary).

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5F—Water Treatment and Quality Alteration

Identifiers: Bacteria, \*Bacterio phage, \*Filters, Phage, Poliovirus, \*Seitz filters, \*Potable water, \*Water treatment, Germany.

Among the different germ-tight filters, which have come into use for the production of solutions free of bacteria, the Seitz-degerminating-layers have attained special interest. They gained their special position by means of the absorbing capacity of the asbestos-layers. The question how to procure drinking-water out of polluted water in case of need and catastrophes by way of Seitz-filters could not be answered sufficiently. The usability of the Seitz-degermination layer for the production of drinking-water in flood-disasters and inundations was tested; the water of the Rhine was taken for the tests. The differing receptivity of the filters for the Newcastle-virus, T3-phage and the polio-virus, type II, seems to depend on the size of the virus and not on their concentration in the water. The break-through of the virus suspended in the Rhine water probably takes place sooner than of the virus bloated in springwater. Taking in account an appropriate safety-surplus a load on a Seitz-EKS-I filter for the emergency-supply with drinking-water up to a maximum of 10 l waste-water or 2500 l river water per cm<sup>2</sup> is recommended. In practice these numbers are of little validity, since such a filter is already stopped up with 0.5 l river-water per cm<sup>2</sup>. EKS-layers are undoubtedly permeable to virus, but the delay in this permeability is long enough to produce—in case of need a microbiologically faultless drinking water.—Copyright 1973, Biological Abstracts, Inc. W74-00472

**HYGIENIC EVALUATION OF THE QUALITY OF WATER OBTAINED BY MEANS OF ELECTRODIALYSIS DESALTING OF IMITATION SEA WATER, (IN RUSSIAN),**  
Nauchno-Issledovatel'skii Institut Gigienny, Moscow (USSR).  
For primary bibliographic entry see Field 03A.  
W74-00478

### SG. Water Quality Control

**METHODOLOGY FOR ASSESSING THE POTENTIAL IMPACT OF URBAN DEVELOPMENT ON URBAN RUNOFF AND THE RELATIVE EFFICIENCY OF RUNOFF CONTROL ALTERNATIVES,**  
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.  
For primary bibliographic entry see Field 02A.  
W74-00001

**STUDIES IN THE ANALYSIS OF METROPOLITAN WATER RESOURCES SYSTEMS, VOL. VI ESTIMATING ECONOMIES OF SCALE IN THERMAL ELECTRIC POWER SYSTEMS SUBJECT TO ENVIRONMENTAL QUALITY CONSTRAINTS,**  
Cornell Univ., Ithaca, N.Y.  
For primary bibliographic entry see Field 06B.  
W74-00002

**INTERACTION OF BULK PRECIPITATION, STREAM WATER, AND SEWAGE IN A SMALL WATERSHED NEAR OXFORD, MISSISSIPPI,**  
Mississippi Univ., University. Dept. of Geology and Geological Engineering.  
For primary bibliographic entry see Field 02A.  
W74-00005

**NITRATE AND NITRITE VOLATILIZATION BY MICROORGANISMS IN LABORATORY EXPERIMENTS,**  
Pennsylvania State Univ., University Park. Dept. of Agronomy.  
J.-M. Bollag.

Copy available from GPO Sup Doc as EP1.23:660-73-002, \$1.00; microfiche from NTIS as PB-224467, \$1.45. Environmental Protection Agency, Technology Series, Report EPA-660/2-73-002, August 1973. 65 p, 8 fig, 13 tab, 33 ref. EPA Project 16080 EIT.

Descriptors: \*Denitrification, \*Nitrates, \*Nitrites, \*Nitrogen cycle, \*Soil microorganisms, Bacteria, Fungi, Microbial cultures, Nitrogen, Nitrous oxide, Environmental effects, Microorganisms, Water pollution control.

Identifiers: Optimizing denitrification, Nitrate-volatilizing microorganisms.

Microbial nitrate and nitrite volatilization was considered as a means to eliminate nitrogen from soil and water in order to inhibit the accumulation of nitrogenous substances as pollutants or health hazardous compounds. Therefore it was attempted to compare nitrate reducing microorganisms in their reactions to different environmental conditions in laboratory experiments. Changing oxygen concentration, pH, temperature, nitrate or nitrite concentration affected differently the denitrification process of various isolated microorganisms. Unfavorable growth conditions led to the accumulation of nitrite if nitrate served as substrate. It was found that certain soil fungi are also capable of volatilizing nitrogen as nitrous oxide. Biological and chemical factors were evaluated during nitrite transformation in autoclaved and non-autoclaved soil by determination of the evolution of nitrogenous gases. During chemical nitrite volatilization, which occurred essentially at a low pH, the major gases evolved were nitric oxide and nitrogen dioxide, but if biological activity was predominant in a neutral and alkaline environment, nitrous oxide and molecular nitrogen were formed. The validity of laboratory observations in relation to field studies in the domain of denitrification is discussed and evaluated. (EPA) W74-00008

**LAND RECLAMATION AND RIVER POLLUTION PROBLEMS IN THE CROAL VALLEY CAUSED BY WASTE FROM CHROMATE MANUFACTURE,**  
Liverpool Univ. (England). Dept. of Botany.  
For primary bibliographic entry see Field 05C.  
W74-00045

**STUDIES IN SWEDEN ON FEASIBILITY OF SOME METHODS FOR RESTORATION OF MERCURY-CONTAMINATED BODIES OF WATER,**  
Swedish Water and Air Pollution Research Lab., Stockholm.  
A. Jernelov, and H. Lann.  
Environmental Science and Technology, Vol 7, No 8, p 712-718, August 1973. 6 fig, 3 tab, 28 ref.

Descriptors: \*Mercury, \*Dredging, \*Chemical precipitation, Bioassay, Fish, Sulfides, Hydrogen ion concentration, Path of pollutants, Absorption, Heavy metals, Water pollution effects, Sediments, Laboratory tests, On-site investigations, Lakes, Rivers, Turbidity, Binders.  
Identifiers: \*Methylation, \*Mobilization, Bioaccumulation, Biotransformation, Lucioperca lucioperca, Biological samples, \*Sweden, Covering, Lake Trummen, Lake Mellanfryken, Lake Garlan, Hallsfjarden Bay, Morrumsan River, Removal.

Brief descriptions are given of laboratory experiments which were conducted to investigate ways of removing mercury from water or of preventing its transformation into forms which accumulate in fish. Dredging, which stirs and suspends the sediment, may increase mercury methylation. Drainage water from dredge spoils also may contain high concentrations of mercury. However, it may be possible to precipitate this mercury out of drainage water. Addition of sulfide ion converted divalent inorganic mercury to mercury sulfide and

reduced the methylation rate of mercury as shown by tests in which mercury accumulations in fish were studied. Covering mercury deposits with mercury-binding or with inert material may reduce methylation rates, but the presence of benthic organisms, currents, and other disturbing influences may contribute to the mixing process thereby eliminating beneficial effects. Raising the pH of the water which favors production of dimethyl mercury, reduced the amount of mercury accumulated by fish. Field studies were made of five areas in Sweden, Lakes Trummen, Garlan, Mellanfryken, Hallsfjarden Bay, and Morrumsan River, which had undergone various types of treatments similar to those investigated in the laboratory tests. The results from some of the methods are promising and warrant further investigation. (Little-Battelle)  
W74-00060

**NOXIOUS SUBSTANCES CONTAINED IN THE WATERS: THEIR ORIGIN, BEARING, AND THEIR ELIMINATION, (IN GERMAN),**  
Mainz Univ. (West Germany). Hygiene Institut.  
For primary bibliographic entry see Field 05B.  
W74-00065

**POLLUTION SKIMMER,**  
B. J. Hoffman.  
U. S. Patent No. 3,753,497, 3 p, 3 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 913, No 3, p 859, August 21, 1973.

Descriptors: \*Patents, \*Oil spills, \*Oil pollution, \*Skimming, Separation techniques, \*Pollution abatement, Equipment, Water pollution control, Water quality control.

The base of this skimmer contains a central drain and several troughs which extend outward from it. The troughs are skewed relative to radii to aid in the formation of a vortex within the drain. The base is supported by several lateral wings each having a density less than that of the liquid. A drain tube is connected to the lower end of the drain and after passing through a pump, discharges the matter into a surface material receptacle which is a multiple outlet container for separating immiscible liquids. A V-shaped weir surrounds the base and wings for use in flowing liquids. The skimmer, weir and a pump may be mechanically connected so all may float as a unit. (Sinha-OEIS)  
W74-00084

**CONVERGING VORTEX APPARATUS FOR SEPARATING OIL FROM WATER,**  
E. A. Boyd.  
U. S. Patent No. 3,753,496, 4 p, 6 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 913, No 3, p 859, August 21, 1973.

Descriptors: \*Patents, Oil spills, \*Oil pollution, \*Pollution abatement, \*Separation techniques, Water pollution control, Water quality control, Equipment, \*Skimming.

This apparatus includes a vortex generator with means to induce rotary motion in fluids flowing through the generator. The generator is maintained in submerged position with its upper end near the water surface in close proximity to an oil slick. The oily water or film is sucked into the generator and then directed through the equipment to a remote reservoir where separation takes place. Screens are provided to filter the water and oil mixture as it is being drawn into the apparatus. The screens may be formed of 1/4 inch expanded metal to screen out large foreign objects which might affect the operation. The apparatus is supported by a triangular arrangement of spherical floats or buoys rigidly secured by a triangular frame. The apparatus is maintained in a stable operating position with the horizontal plane of its vanes parallel to the surface of the water. The

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Water Quality Control—Group 5G

floats are spaced to permit a free, undisturbed flow of water and oil. When being used in conjunction with a support ship or barge, the casing can be suspended by suitable lines from a ship-mounted boom. An operator aboard ship manually manipulates a hoist line to maintain the casing at the desired level relative to the water line. (Sinha-OEIS)  
W74-00085

**SEPARATING APPARATUS,**  
V. S. Aiello, J. P. Albanese, R. V. Anderson, and  
F. Platt.  
U. S. Patent No. 3,753,492, 5 p, 8 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 913, No 3, p 858, August 21, 1973.

Descriptors: \*Patents, \*Separation techniques, \*Oil spills, Equipment, \*Oil pollution, Water pollution control, \*Pollution abatement, Water quality control.

Separation of oil and water is accomplished by directing the water with a layer of oil floating on it into a vertical cylindrical tank extending above and below the liquid surface. At the bottom of the tank, an impeller maintains the liquid in rotation about a vertical axis, creating a vortex. The oil appears in the vortex as a layer of maximum thickness at the center. A float having a contour symmetrical about a vertical axis centers itself in the vortex. The float carries an outlet pipe for the oil whose open lower end is submerged in the liquid at the center of the vortex. The outlet pipe is preferably rigid, its top connects to a flexible pipe section which may move laterally by small amounts so as to allow the float to follow lateral movements of the vortex. The pipe is also vertically extendable, so as to adjust to changes in the liquid level with respect to the sides of the tank. The apparatus may be mounted on a twin hulled vessel and propelled through the water to remove an oil slick. The inlet for the oil and water mixture is at the bow end of the tank, with the water outlet at the stern. (Sinha-OEIS)  
W74-00086

#### APPARATUS FOR REMOVING OIL FROM OIL-CONTAMINATED WATER, J. Cincotta.

U. S. Patent No. 3,752,762, 2 p, 2 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 913, No 2, p 654, August 14, 1973.

Descriptors: \*Patents, \*Oil pollution, Oil spills, \*Oily water, \*Filtration, \*Pollution abatement, Water pollution control, Water quality control, \*Industrial wastes, Liquid wastes, Separation techniques.  
Identifiers: \*Pumice stones.

Pumice stones are placed in a container having an open top, a removable bottom and porous opposed first and second side walls. Oil contaminated water is directed through the first porous side wall, through the container and out the second side wall. The pumice stones in the container absorb the oil from the water, and when they become saturated the bottom of the container is removed allowing the pumice stones to drop on a conveyor. The conveyor transports them to a steam-cleaning area. After being cleaned they are returned to be used again. (Sinha-OEIS)  
W74-00087

**METHOD FOR CONTROLLING ALGAE POLLUTION,**  
Kettering Scientific Research, Inc., Yellow Springs, Ohio. (Assignee)  
R. W. Treharne, and T. E. Brown.  
U. S. Patent No. 3,752,747, 4 p, 2 fig, 2 tab, 11 ref; Official Gazette of the United States Patent Office, Vol 913, No 2, p 651, August 14, 1973.

Descriptors: \*Patents, Eutrophication, \*Electrolysis, \*Bacteria, Algae, \*Algal control, Water pollution control, Water quality control, \*Pollution abatement, Azotobacter, E. coli.  
Identifiers: Chromatium, R. rubrum.

The water is subjected to electrolysis with electrochemically inert electrodes or with an electrochemically active anode and an electrochemically inert cathode to destroy or to control the growth of algae. Most forms of algae are destroyed by impressing, per liter of water, about 15 volts and 150 milliamperes of electric potential between the electrodes over a 72 hour period. When an active anode is used it releases metal ions toxic to algae, and a detector electrode is used to sense the toxic ion concentration so that a predetermined concentration lethal to algae is maintained without rising to a level of being toxic to fish or humans. This system may be used for the destruction of E. coli, R. rubrum, Chromatium, Azotobacter, and other bacteria. (Sinha-OEIS)  
W74-00088

#### OIL RECOVERY VESSEL, Oil Recovery Systems, Inc., Mineola, N.Y. (Assignee) E. E. Lithen.

U. S. Patent No. 3,752,317, 4 p, 4 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 913, No 2, p 547, August 14, 1973.

Descriptors: \*Patents, \*Oil spills, \*Oil pollution, Water pollution control, \*Pollution abatement, Water quality control, Equipment.  
Identifiers: \*Scoops.

The vessel's hull has a scoop projecting forward for collecting a mixture of oil and water from the surface of the body of water. The scoop is pivotally mounted and is vertically movable to compensate for sea conditions and changes in the waterline of the vessel. Fluid collected under the action of gravity and the forward motion of the vessel is directed through conduits into submerged separation tanks under conditions of laminar flow. After decanting, a pumping device causes removal of the collected oil. The oil is then transferred to storage tanks and the water is discharged. (Sinha-OEIS)  
W74-00089

**FLOATING OIL CONTAINMENT BOOM,**  
Murphy-Pacific Marine Salvage Co., New York. Merritt Div. (Assignee)  
R. K. Thurman.

U. S. Patent No. 3,751,925, 3 p, 3 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 913, No 2, p 447, August 14, 1973.

Descriptors: \*Patents, Equipment, \*Oil spills, \*Oil pollution, \*Pollution abatement, Water pollution control, Separation techniques, Water quality control.  
Identifiers: \*Booms.

This floating oil containment boom comprises floating units connected by flexible joints. Each unit consists of a rigid, flat barrier provided with a metal drum for supporting it in a vertical position in a body of water with part extending above the water surface and part submerged. Secured between adjacent units are flexible panels preferably made of waterproof textile material, which may extend below the barriers to register with flexible curtains of the same material attached to the bottoms of the barriers and weighted to keep them flat. Each unit is secured to strong lines which carry the stresses applied in towing or heavy seas and the leading unit in tow may be provided with a bow plane or like element to facilitate towing an assembly of units to or from a working location. (Sinha-OEIS)  
W74-00090

**GROUND-WATER NITRATE POLLUTION IN RURAL AREAS,**  
Illinois State Water Survey, Urbana.  
For primary bibliographic entry see Field 05B.  
W74-00095

**MODIFICATION OF WATER QUALITY DURING ARTIFICIAL GROUNDWATER RECHARGE,**  
For primary bibliographic entry see Field 04B.  
W74-00116

**REGIONAL PERSPECTIVES,**  
Tennessee Valley Authority, Chattanooga.  
A. J. Wagner.

In: The Nation's Environment—Problems and Action, p 19-30, 1971. East Tennessee State University, Johnson City.

Descriptors: \*Planning, Water pollution control, \*Soil contamination, \*Alternative planning, Long-term planning, Future planning (Projected), Economic efficiency, \*Regional development.  
Identifiers: \*Tennessee Valley.

The shift from an agrarian society to an industrialized one has caused man to lose touch with true quality in life. A major cause of this situation is the multiplicity of environmental ills associated with the age of technology. Technology itself, however, is not so much the villain as is what man has done with his technology. If nature is seen as an integrated system, with irrevocable relationships between air, water and land, then the problems of the environment can be seen in total perspective and a regional approach to planning becomes feasible. The Tennessee Valley is cited and discussed as a good example of how such a perspective can and does work—particularly in such nominally unrelated areas as garbage disposal, rural renovation, water and air pollution control and thermal pollution control. (Wadley-Florida)  
W74-00123

**WATER POLLUTION,**  
Geological Survey, Washington, D.C.  
For primary bibliographic entry see Field 05A.  
W74-00124

#### PROCEEDINGS: LIVESTOCK WASTE MANAGEMENT RESEARCH REVIEW.

Nebraska Center for Continuing Education, Lincoln, Nebraska, November 29-30, 1972, 133 p, 2 tab.

Descriptors: \*Livestock, \*Farm wastes, \*Management, Air pollution, Water pollution, Soil contamination, \*Waste treatment, Waste storage, Waste disposal, Runoff, \*Feed lots.

A multi-disciplinary team effort revealed the objectives and priorities in fighting agricultural pollution. Specific governmental and university programs were pinpointed, outlined, and reviewed. The papers presented were, in most instances, rather general. (See W74-00126 thru W74-00144) (Frantz-East Central)  
W74-00125

**NATIONAL LIVESTOCK WASTE MANAGEMENT PROGRAM,**  
Agricultural Research Service, Beltsville, Md.  
R. G. Yeck.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 5-10, November 29-30, 1972.

Descriptors: \*Farm wastes, \*Feed lots, Groundwater, \*Recycling, \*Livestock, Air pollution, Water pollution, Soil contamination, Runoff, Waste disposal, \*Waste treatment, Odor.

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

Identifiers: Livestock waste management research.

Farm waste research project areas are discussed in an overview. Some areas of research receive adequate concentration while other topics such as recycling farm wastes, are inadequately considered. Projects include those seeking to control feedlot runoff and odor due to land applications of farm wastes. Researchers are urged to cooperate and to work concurrently on related projects to prevent land, air, and water pollution. Recent cuts into research allocations necessitate increased teamwork. (See also W74-00125) (Frantz-East Central) W74-00126

**REGIONAL LIVESTOCK WASTE MANAGEMENT PROGRAM,**  
Nebraska Univ., Lincoln Agricultural Experiment Station.

R. W. Kleis.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 11-15, November 29-30, 1972, 1 tab.

Descriptors: \*Research and development, \*Livestock, \*Farm wastes, \*Management, Air pollution, Water pollution, Waste treatment, Waste storage, \*Waste disposal, Recycling, Nitrogen, Nutrients, Confinement pens, \*Regional development.

Livestock waste management projects and objectives are listed for state agricultural experiment stations. The primary purpose is to enhance the total effectiveness of all participating agencies and institutions while preventing unnecessary duplication. Present efforts have been building up, as have problems of waste management, for fifteen years. Needed are projections of not only economic costs, but also of social and environmental costs. (See also W74-00125) (Frantz-East Central) W74-00127

**POLLUTION OF AIR, WATER, AND SOIL BY LIVESTOCK,**  
Agricultural Research Service, Lincoln, Nebr.

L. F. Elliott.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 23-28, November 29-30, 1972, 28 ref.

Descriptors: \*Air pollution, \*Water pollution, \*Soil contamination, \*Farm wastes, Feed lots, Odor, Surface waters, Groundwater, \*Livestock, Spectroscopy, Chromatography, Nitrates, Oxidation, Soil profiles, Nebraska, Kansas.

Air, water, and soil pollution research projects are discussed. Air pollution studies include attempts at developing compounds which can reliably indicate odors. While surface water pollution from feedlots is no longer deemed a major problem, research has been necessary for the prevention of soil pollution and groundwater pollution at feedlot sites. Sealants in holding ponds and debris basins and management practices for land application of feedlot wastes are also being studied. (See also W74-00125) (Frantz-East Central) W74-00128

**APPLICATION, UTILIZATION AND DISPOSAL OF LIVESTOCK WASTE,**  
Nebraska Univ., Lincoln Dept. of Agricultural Engineering.

H. Wittmuss.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 31-35, November 29-30, 1972.

Descriptors: \*Waste disposal, \*Waste treatment, \*Farm wastes, \*Livestock, \*Feed lots, Runoff, Irrigation, Nitrates, Nebraska, Kansas, North Dakota.

Identifiers: Mounding.

Livestock waste disposal from unpaved, beef cattle feed lots has the greatest pollution potential. Separation of liquid and solid wastes is important. Separated liquids have been applied to cropped land at up to 36 inches a year for two years without problems, however, long range effects of effluent application need further study. Likewise needed is the determination of the highest sustained rates at which solid wastes may be applied without soil deterioration and salinization. Mounding sometimes aids in denitrifying wastes. Other waste management systems used with varying degrees of success are: (1) drying entire waste, (2) incineration, (3) composting, (4) refeeding, (5) protein production, (6) building blocks, (7) raw material for oil, and (8) methane production. (See also W74-00125) (Frantz-East Central) W74-00129

#### DESIGN AND MANAGEMENT OF RUNOFF CONTROL SYSTEMS,

Agricultural Research Service, Lincoln, Neb.

J. A. Niemeyer.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 39-43, November 29-30, 1972, 18 ref.

Descriptors: \*Farm wastes, \*Feed lots, Cattle, Runoff, Drainage, Flumes, Terracing, Nebraska, \*Management, \*Waste treatment, Waste disposal.

Identifiers: \*Runoff control system, Debris basin, Holding pond, Disposal area.

A runoff control system has been successfully operated on two 1000 head feedlots. Designed from the University of Nebraska Field Laboratory, the system consists of three components: debris basin, holding pond, and controlled disposal area. This system was proven superior to the one-pond system for liquid and solid wastes. Broad basin terraces may be beneficial in flood protection as well as in runoff control. Shallow debris basins are recommended for minimizing waste odors. Wooden dams with crushed rock release runoff from debris basins. The suggested disposal area is from one half up to the full size of the feedlot itself. Rainfall, slope length, and size of operation are among factors which affect runoff control design. Alternative runoff control systems and their relative costs are discussed. (See also W74-00125) (Frantz-East Central) W74-00130

#### CHARACTERISTICS OF ANIMAL WASTES AND RUNOFF,

Agricultural Research Service, Lincoln, Neb.

J. R. Ellis.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 49-53, November 29-30, 1972, 29 ref.

Descriptors: Conductivity, \*Farm wastes, Runoff, Thermal properties, Nutrients, Nitrates, Phosphorus, Ammonia, Pathogenic bacteria, Water pollution, \*Physical properties, \*Chemical properties, \*Biological properties, Animal parasites, Amino acids, Waste disposal.

Identifiers: Pollution potential, Waste management, \*Animal wastes runoff.

Chemical, physical, and biological properties of farm waste must be further studied to correctly determine the pollution and management problems they present. The pollution potential discharged into streams requires chemical analysis of farm wastes, while design of runoff control structures lends itself to determination of physical properties. Further research is likewise needed in as-

sessing life of microorganisms in feces and in runoff control systems. Because comparatively little information has been established regarding the physical properties of farm waste, further research is suggested in characterizing feces, urine, and housed feed lot wastes, especially regarding gross energy, freezing point, and thermoconductivity. (See also W74-00125) (Frantz-East Central) W74-00131

**WASTE MANAGEMENT AND ANIMAL PERFORMANCE,**  
Nebraska Univ., Lincoln. Dept. of Animal Science.

S. Farlin.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 57-59, November 29-30, 1972, 5 ref.

Descriptors: \*Feed lots, \*Farm wastes, \*Waste treatment, Nutrition, Nebraska, Missouri, Iowa, Minnesota, \*Management.

Identifiers: Gains, Animal performance, Mounding, Cold/warm slot housing.

Increasing animal performance, hence profits, depends upon feed lot modifications such as mounding wastes in winter and decreasing cattle density. Also, cattle with access to sheltered lots generally show increased gains, higher grade carcasses, and higher dressing percentages than cattle in open lots. Additional research may be the key to making more accurate estimates on the effects of housing and waste management on returns from feeding cattle. (See also W74-00125) (Frantz-East Central) W74-00132

**EDUCATION, ACTION AND REGULATORY PROBLEMS OF ANIMAL WASTE MANAGEMENT,**  
Nebraska Univ., Lincoln.

E. A. Olson.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 63-66, November 29-30, 1972.

Descriptors: Nebraska, \*Economics, Oxidation lagoons, \*Waste disposal, Ventilation, \*Farm wastes, Odor, \*Feed lots, Cattle, Hogs, Inlets (Waterways).

Identifiers: \*Voluntary waste control, \*Regulatory waste control.

Problems associated with shifting from voluntary waste control to regulations adopted by the Environment Control Council are outlined. Inspections of feed lots and investigations of existing waste management systems are in progress. Also outlined is the educational program (including economic factors) coordinated by county extension agents, consulting engineers and the Department of Environmental Control. Maintenance of present systems and future research needs are discussed in outline form. (See also W74-00125) (Frantz-East Central) W74-00133

**PROBLEMS OF ANIMAL WASTE MANAGEMENT FROM THE LIVESTOCK FEEDER VIEWPOINT,**  
Nebraska Livestock Feeders Association, Fairmont Environmental Management Committee.

W. Krejci.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 69-71, November 29-30, 1972.

Descriptors: \*Feed lots, \*Farm wastes, Runoff, Odor, \*Cattle, \*Hogs, Lagoons, Surface waters, Nebraska, Air pollution, \*Legal aspects.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Water Quality Control—Group 5G

Livestock feeders have sacrificed some of their freedom for the improvement of the environment. Arguments and recommendations are considered from the feeders' viewpoint. Filtering runoff through fields is a suggested alternative to concentration of runoff into holding ponds. Also, swine wastes should be as much in governmental focus as are cattle waste problems. More extensive data will be required to control some feed lot runoff problems, but proper management and further governmental and educational cooperation will aid feeders. (See also W74-00125) (Frantz-East Central)  
W74-00134

**POLLUTION OF AIR, WATER AND SOIL BY LIVESTOCK,**  
Agricultural Research Service, Lincoln, Nebr.  
T. M. McCalla, and G. E. Schuman.  
In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 75-79, November 29-30, 1972.

Descriptors: \*Air pollution, \*Water pollution, \*Soil contamination, \*Feed lots, Odor, Runoff, Waste storage, Waste treatment, Waste disposal, Livestock, \*Farm wastes, Nitrates, Groundwater. Identifiers: Abandoned feedlot reclamation.

Although researchers have solved many problems, they have uncovered many areas which require further research. A standard method for defining odorous compounds is needed. More reliable maintenance and sealants are needed to prevent seepage into ground water. Experiments in land disposal should be carried out for at least ten years. (See also W74-00125) (Frantz-East Central)  
W74-00135

**APPLICATION, UTILIZATION AND DISPOSAL OF LIVESTOCK WASTES,**  
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.  
O. E. Cross.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 83-89, November 29-30, 1972, 14 ref.

Descriptors: \*Farm wastes, \*Feed lots, \*Waste disposal, \*Recycling, Water pollution, \*Application methods, Irrigation, Soil management, Physical properties, Chemical properties, Runoff, Groundwater, Effluents, Nitrates, Centrifugation, Conductivity, Phytotoxicity, Cattle, Hens, Turkeys. Identifiers: Micronutrients.

Research plans for fourteen projects are given. Research objectives and problems to be faced are discussed. Current problems include waste management, waste utilization, runoff control systems, effluent disposal and effects of disposal on agricultural land. (See also W74-00125) (Frantz-East Central)  
W74-00136

**RESEARCH NEEDS FOR THE DESIGN AND MANAGEMENT OF BEEF FEEDLOT RUNOFF CONTROL SYSTEMS,**  
Agricultural Research Service, Lincoln, Nebr.  
N. P. Swanson.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 93-97, November 29-30, 1972, 4 ref.

Descriptors: \*Feed lot, \*Waste disposal, Nebraska, \*Farm wastes, Pollutants, \*Cattle, Gravity, Irrigation, Runoff, Effluents, Infiltration, \*Waste management. Identifiers: Buffer strips, Field disposal, \*Waste runoff control.

Current research projects should partially resolve feed lot runoff problems, but the goal is set for 'zero pollution.' New plans and objectives for overland flow, buffer strips, feed lot floor design and topographical research are discussed. These methods require proof of environmental acceptability. Proper distribution of effluent is of major concern to the Soil Conservation Service. Odor, because of nuisance suits, may be the greatest runoff problem. The facilities of the University of Nebraska Field Laboratory and Meat Animal Research Center is aiding research in several runoff control areas. (See also W74-00125) (Frantz-East Central)  
W74-00137

#### CHARACTERISTICS OF LIVESTOCK WASTE AND RUNOFF,

Agricultural Research Service, Lincoln, Nebr.  
C. B. Gilbertson.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 101-103, November 29-30, 1972, 29 ref.

Descriptors: \*Farm wastes, \*Physical properties, \*Chemical properties, \*Feed lots, Coliforms, Pathogenic bacteria, Lagoons, Management, \*Waste disposal, Degradation, Runoff, Cattle, Water pollution sources, \*Waste treatment.

Identifiers: Cationic nutrients, Mounding, Microbial properties.

Defining physical, chemical and microbial characteristics is basic to current and future farm waste disposal and runoff control. Three projects are discussed whose aims are determining physical and chemical properties in relation to the mechanics of waste disposal. Approximately three years will be required to complete needed research in these areas. (See also W74-00125) (Frantz-East Central)  
W74-00138

#### WASTE-INDUCED PROBLEMS OF HOUSED LIVESTOCK,

Agricultural Research Service, Clay Center, Nebr. Meat Animal Research Center.  
T. E. Bond.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 107-110, November 29-30, 1972, 1 tab.

Descriptors: \*Livestock, \*Sheep, \*Cattle, \*Hogs, Nebraska, Recycling, Pollutants, Odor, Waste disposal, \*Confinement pens, \*Feed lots, Nutrients, Oxidation, \*Waste treatment, Transportation.

Identifiers: \*Housed confinement.

Although farm waste problems are in great need of research, livestock confinement provides numerous advantages: greater mechanization of chores, animal protection, and potentially increased production. Specific problems related to waste collection, treatment, transportation and disposal are listed in order of priority: odors, nutrient or chemical control or adjustment, treatment for reduction, land disposal, re-use, and system selection. Housed livestock research facilities at the Meat Animal Research Center are described and possible research suggestions are listed. (See also W74-00125) (Frantz-East Central)  
W74-00139

#### OTHER RESEARCH NEEDS,

Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.  
W. E. Splinter.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 113-114, November 29-30, 1972.

Descriptors: \*Farm wastes, Proteins, Runoff, \*Feed lots, \*Waste disposal, \*Recycling, Confinement pens, Aquatic animals, Hogs, Cattle, Filters, Nebraska.  
Identifiers: \*Paunch manure, Horses.

Alternate methods of recycling cattle manure, the use of grass as a runoff filter, and the treatment and disposal of swine, horse and aquatic wastes should further be explored. (See also W74-00125) (Frantz-East Central)  
W74-00140

#### REGIONAL ADMINISTRATOR'S SUMMARY,

Agricultural Research Service, Peoria, Ill. North Central Region.

T. B. Kinney, Jr.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 117-119, November 29-30, 1972.

Descriptors: \*Farm wastes, \*Research priorities, \*Coordination, \*State governments, \*Federal government, \*Local governments, Administration, Waste treatment.

The regional administrator encourages research efficiency by increased cooperation among state, federal and industrial groups. Research priorities must be justly established and sound research must be carried out on high priority problems. (See also W74-00125) (Frantz-East Central)  
W74-00141

#### AREA DIRECTOR'S SUMMARY,

Agricultural Research Service, Clay Center, Nebr. Meat Animal Research Center.  
K. E. Gregory.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 125-126, November 29-30, 1972.

Descriptors: \*Farm wastes, \*Management, \*Feed lots, \*Research priorities, Expenditures, Costs.

High priority problems call for specific research approaches. Shortage of funds necessitates consolidation of some programs and reduction of others. Resources should be budgeted for efficient research at all locations. (See also W74-00125) (Frantz-East Central)  
W74-00143

#### CONCLUDING COMMENTS,

Nebraska Univ., Lincoln. Agricultural Experiment Station.

H. W. Ottoson.

In: Proceedings: Livestock Waste Management Research Review, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 127-129, November 29-30, 1972.

Descriptors: \*Farm wastes, Crop production, \*Livestock, Soils, Marketing, \*Waste disposal, Odor, \*Feed lots, Confinement pens, Nebraska, \*Waste treatment.

The livestock waste management conference was a success. The conference was a bench mark inventory on which research in livestock waste management may be planned in the future. (See also W74-00125) (Frantz-East Central)  
W74-00144

#### RELIABILITY OF URBAN WATER QUALITY MANAGEMENT,

Texas A and M Univ., College Station. Dept. of Industrial Engineering.

C. S. Shich, J. K. Garner, and G. L. Curry.  
Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 27 p, 8 fig, 5 tab, 17 ref.

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

Descriptors: \*Water quality, \*Management, \*Reliability, Water pollution control, Treatment facilities, \*Optimization, Regions, Operating costs, Probability, Decision making, Economics, Mathematical models, Systems analysis, \*Texas.

Identifiers: \*Urban water, \*Cost minimization, Chance-constrained quadratic programming, \*Parametric analysis, \*San Antonio River Basin (Tex), Managerial goals, Sensitivity analysis.

In the reduction of the liability of pollution to urban water resources, the probabilistic nature of the performance of pollution control facilities and environmental responses must not be ignored. Reliability is defined as the measure of effectiveness for the attainment of water quality managerial goals. An optimization model is developed for the determination of the best pollution control policies for each treatment facility in terms of the minimization of total regional cost requirements, the quality control requirements, and the reliability desired. A chance-constrained quadratic programming technique coupled with parametric analysis is utilized as the basic solution approach. A practical problem based on the situation existing in the San Antonio River Basin Region of Texas has been used to illustrate application of the technique. The implications resulting from a sensitivity analysis of this model are discussed. (Bell-Cornell)

W74-00180

**NEED FOR METROPOLITAN WATER BALANCE INVENTORIES,**  
American Society of Civil Engineers, Marblehead, Mass. Urban Water Resources Research Program. For primary bibliographic entry see Field 06A.

W74-00187

**HYGIENIC EFFICACY OF SANITARY PROTECTION MEASURES FOR SURFACE WATERS IN THE REGION OF OIL-REFINING AND OIL-CHEMICAL ENTERPRISES, (IN RUSSIAN),**

Nauchno-Issledovatel'skii Institut Gigieny i Profzabolevanii, Ufa (USSR). For primary bibliographic entry see Field 05B.

W74-00241

**SURVEY OF POTENTIAL VECTORS OF YELLOW FEVER IN TANZANIA, (IN FRENCH),**  
Office de la Recherche Scientifique et Technique Outre-Mer, Bondy (France). Services Scientifiques Centraux.

J. Mouchet.

Bull W H O. Vol 46, No 5, p 675-684. 1972. Illus. (English summary).

Identifiers: \*Aedes control, DDT, Dieldrin, Organic compounds, Phosphorus, Survey, \*Tanzania, \*Vectors (Yellow fever).

A survey was made in Nov.-Dec., 1969, in the central and western parts of Tanzania. This is the start of the rainy season, although rains had not begun in most of the woodland steppe areas. Towns and villages (41) in the woodland steppe, woodland savanna, Lake Victoria shores, highlands and intermediate regions were surveyed. The density of *Aedes aegypti* was evaluated in terms of the house index, the container index and the Breteau index; there is no standard index for *Ae. simpsoni*. No breeding of *Ae. aegypti* in drinking water was observed. It was found breeding mainly in outside containers and tree-holes; its seasonal fluctuation follows the rainfall pattern. Thus, the negative results recorded in the woodland steppe where the rains had not begun cannot be considered definite proof of the absence of this mosquito. The indices of density were generally low, they varied greatly from place to place, even in similar ecological conditions. The only color form of *Ae. aegypti* found was the black one (formosus). Larvae of *Ae. simpsoni* were plentiful in and near the villages. They were frequently as abundant as those of *Ae. aegypti* in their natural breeding sites. Thus, in the

areas studied, *Ae. simpsoni* is a period domestic and a feral species. The other potential vectors were seldom encountered; this is not surprising since the survey was biased toward towns and villages. Larvae of *Ae. stokesi*, *Ae. schwetzi*, *Ae. marshalli* and those of several species of *Culex* and *Toxorhynchites brevipalpis* were among the culicine larvae collected. Eight Tanzanian strains of *Ae. aegypti* were colonized in the laboratory and tested for susceptibility to various insecticides. Three strains (those from Tanga, Dar es Salaam, and the Pugu forest) were resistant to dieldrin; all of them were susceptible to DDT and organophosphorus compounds. Copyright 1973, Biological Abstracts, Inc.

W74-00242

**EFFECTS OF ARTIFICIAL DESTRATIFICATION ON ZOOPLANKTON IN PARVIN LAKE, COLORADO,**  
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Sciences.

For primary bibliographic entry see Field 05C.

W74-00243

**ENZYMIC REMOVAL OF OIL SLICKS,**  
Oklahoma State Univ., Stillwater. Dept of Biochemistry.

R. K. Golson, and P. E. Guire.

Available from the National Technical Information Service as AD-757 071, \$3.00 in paper copy, \$1.45 in microfiche. Final Report, March 4, 1973. 14 p, 7 ref, append. Project No 137-876/6-3-70 (Code 443). Contract No N00014-71-A-0004-0001.

Descriptors: \*Oil spills, \*Enzymes, Toxicity, *Daphnia*, Oil pollution, Emulsifiers, Yeasts, Microbial degradation, Organic compounds.

Identifiers: \*Oil removal, Cleanup, *Candida* petrophilum, *Pseudomonas aeruginosa*, Hexadecane.

A procedure to modify enzymes chemically in order to cause them to adhere to a hydrocarbon-water interface without appreciable loss of enzymatic activity has been developed. So far this procedure has only been applied to 'model' enzymes (muramidase, ribonuclease and 2 lipases); however, it is hoped that it can also be successfully used with purified microbial hydrocarbon oxidizing enzymes when they become available. Partial purification and characterization of extracellular emulsifying factors, produced by microorganisms (*Candida* petrophilum and *Pseudomonas aeruginosa*) during their growth on hydrocarbons was also accomplished. These factors are potentially useful in clean up of oil spills by providing an easily biodegradable non-toxic detergent. Preliminary toxicity tests with the water flea (*Daphnia magna*) have indicated an LD<sub>50</sub> concentration after 48 hours exposure, of 40 percent for the yeast culture supernatant and 8 percent for the *Pseudomonas* culture supernatant. (Little-Battelle) W74-00284

**CAPITAL AND OPERATING COSTS OF POLLUTION CONTROL EQUIPMENT MODULES, VOLUME I, USER GUIDE,**  
ICARUS Corp., Silver Spring, Md.

H. G. Blecker, and T. W. Cadman. Copy available from GPO Sup Doc as EP1.23/3:73-023a, \$2.40; microfiche from NTIS as PB-224 535, \$1.45. Environmental Protection Agency, Socioeconomic Studies Series, Report, EPA-R5-73-023a, July 1973. 255 p, 4 fig, 51 tab, 4 ref. EPA Project 21AQJ. 68-01-0717.

Descriptors: \*Cost analysis, \*Costs, \*Pollution abatement, Cost comparisons, Economics, Annual costs, Construction costs, \*Operating costs, Estimated costs, Manuals, \*Engineers estimates, \*Capital costs, Water pollution control.

The User's Guide describes the scope of the cost manual on installation and operation of pollution control equipment modules. Illustrative examples are given enabling the user to prepare estimates of conceptual environmental protection processes using the companion Data Manual. Emphasis is placed upon the determination of the installed and annual costs of individual process equipment modules, determination of the installed and annual process costs, and evaluation of the potential process profitability in those cases where profit is a motive. (See also W74-00308) (Abel-EPA) W74-00307

**CAPITAL AND OPERATING COSTS OF POLLUTION CONTROL EQUIPMENT MODULES, VOLUME II, DATA MANUAL,**  
ICARUS Corp., Silver Spring, Md.

H. G. Blecker, and T. W. Cadman. Copy available from GPO Sup Doc as EP1.23/3:73-023b, \$1.90; microfiche from NTIS as PB-224 536, \$1.45. Environmental Protection Agency, Socioeconomic Studies Series, Report, EPA-R5-73-023b, July 1973. 183 p, 10 ref. EPA Project 21AQJ. 68-01-0717.

Descriptors: \*Cost analysis, \*Costs, \*Pollution abatement, Cost comparisons, Economics, Annual costs, Construction costs, \*Operating costs, Estimated costs, Manuals, \*Engineers estimates, \*Data collections, \*Capital costs.

This Data Manual presents, in convenient graphical and tabular form, cost information for installed equipment item modules on separate data sheets. Each data sheet conforms to a uniform style providing information on the specific item and adjustments to a typical installation, construction, or design. The methodology used in developing this data and the techniques suggested for its use are described in detail in the companion User Guide. (See also W74-00307) (EPA) W74-00308

**HYDROGEOLOGICAL BASIS FOR PROTECTION OF GROUNDWATER AND WATER WELLS FROM POLLUTANTS (GIDROGEOLOGICHESKOYE OBOSNOVANIYE ZASHCHITY PODZEMNYKH VOD I VODOZABOROV OT ZAGRYAZHENIY),**

For primary bibliographic entry see Field 05B. W74-00347

**THE POLITICS OF WATER POLLUTION,**  
Connecticut Univ., Storrs. Inst. of Water Resources.

D. M. Fox.

Completion Report, 1973, 15 p. OWRR A-046-CONN (1). OWRR 14-31-0001-3507.

Descriptors: \*Political aspects, \*Water pollution control, \*Decision making, Water policy, Pollution abatement, Federal Government, State Governments, \*Connecticut, Agriculture, Industries, Legal aspects, State jurisdiction, Legislation.

Identifiers: Interest groups, Federal grants, Questionnaires, Connecticut Water Resources Commission, Connecticut Clean Waters Act of 1967.

A majority of the commissioners on the Water Resources Commission (WRC) of Connecticut, in existence from 1957 to 1971, represented, directly or indirectly, interests which pollute, including agriculture, municipal government, and industry. These commissioners, rather than representatives of ecological groups, dominated WRC decisions. Case studies of two polluters - the City of New Haven and the Scovill Corporation of Waterbury, lead to the following conclusions: (1) efforts to end pollution have been delayed by the slowness of the WRC in reviewing abatement plans, (2) the failure of the Federal government to fund pollution abate-

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

### Water Quality Control—Group 5G

ment grants at levels originally promised have slowed down or stopped abatement. A great deal has been done under the 1967 Connecticut Clean Waters Act to reduce pollution. However, the composition of the WRC, the failure of the state government to fund WRC at levels permitting hiring of additional staff, and the failure of the federal government to fund its contribution at levels originally expected have prevented the full attainment of the goals set forth in the act.

W74-00391

#### AGRICULTURE AND POLLUTION—SOCIO-ECONOMIC ASPECTS, Kentucky Univ., Lexington. Coll. of Agriculture.

A. F. Bordeaux, Jr.

In: Quality of the Environment, Socio-Economic, Biological and Engineering Aspects, papers presented at the College of Agriculture Annual Conference, University of Kentucky, January 5-7, 1971. p 1-7 (1971), 6 ref.

Descriptors: \*Water pollution, Economics, Surface waters, Technology, \*Fertilizers, Conservation, Insecticides, \*Farm wastes, Nitrates, Farm prices, Costs, \*Waste disposal, Water treatment, DDT, Regulation, Kentucky, Agriculture.

As the interest in environmental protection heightens in the United States, farmers are increasingly criticized as polluters of air and water. Costs of pollution must be met and farmers, declining in political power, feel the most pressure. Alternative chemicals are available to replace the DDT family, but they are less effective and more expensive. Providing for economical environmental protection requires the cooperative efforts of economists, engineers and scientists. (Frantz-East Central)

W74-00395

#### DRAIN INSTALLATION FOR NITRATE REDUCTION, Southwestern Irrigation Field Station, Brawley.

L. S. Willardson, B. D. Meek, L. E. Grass, G. L. Dickey, and J. W. Bailey.

Paper No. 69-734 presented at the 1969 Winter Meeting American Society of Agricultural Engineers, Chicago, Illinois, December 9-12, 1969. 2 tab, 2 fig.

Descriptors: \*California, \*Drains, \*Installation, \*Nitrates, Permeability, Sumps, Irrigation, Electrical conductance, Leaching, Percolation, Groundwater, Denitrification.

Identifiers: \*San Joaquin Valley (Calif), Panoche silty clay.

Because farmers remove more nitrates from the soil than they put into it, denitrification or reducing nitrates to nitrogen gas, is sometimes desirable. A field experiment was installed in California's San Joaquin Valley to test submergence of drains as a means of denitrification. The Panoche silty clay area was irrigated four times during the months of July and August. Samples made of the soil showed that the side of the drain oriented toward the ground water source had the highest reading of nitrate content. This indicated that soil denitrification depends ultimately upon saturation from irrigation as well as sufficient presence of organic carbon matter and a shortage of oxygen. Along with soil denitrification, ground water with high nitrate content was also diluted. (Frantz-East Central)

W74-00398

#### UTILIZATION OF DIFFERENT LEVELS OF POULTRY LITTER NITROGEN BY SHEEP, Virginia Polytechnic Inst., Blacksburg. Dept. of Biochemistry and Nutrition; and Virginia Polytechnic Inst., Blacksburg. Dept. of Animal Science.

A. N. Bhattacharya, and J. P. Fontenot.

Journal of Animal Science, Vol 24, p 1174-1178, 1965. 4 tab, 28 ref.

Descriptors: \*Sheep, \*Nitrogen, Fertilizers, \*Protein, Feeds, \*Farm wastes, Nutrition, Chemical properties, Samples, \*Metabolism, \*Recycling. Identifiers: Digestibility, Nitrogen retention, \*Poultry litter, Peanut hulls, Crude protein, Soybean protein.

A series of three metabolism trials were conducted with eight yearling wethers to study the utilization of the nitrogen in auto-claved peanut-hull broiler litter, containing 22.6% crude protein (dry basis). Poultry litter nitrogen replaced approximately 25, 50 and 100% of the nitrogen of a purified ration containing isolated soybean protein as the nitrogen source. Apparent digestibility of crude protein in the rations decreased significantly with each increase in litter nitrogen level above 25%. However, the depression was small when litter supplied 50% of the nitrogen. When litter supplied 25 and 50% of the nitrogen, digestibility of litter crude protein calculated by difference was 67 and 65%, respectively, compared with 71% when only soybean protein was used. Nitrogen retention, expressed as grams per day, percent of nitrogen intake or percent of absorbed nitrogen, was significantly lower at the 100% litter nitrogen level than when no litter was used. There were no consistent differences in ammonia and non protein nitrogen content of rumen fluid and in concentration of various nitrogen fractions in the blood plasma of sheep fed the different rations. (East Central)

W74-00401

#### DEHYDRATED POULTRY MANURE AS A CRUDE PROTEIN SUPPLEMENT FOR SHEEP, Agricultural Research Service, Beltsville, Md. Biological Waste Management Lab.

L. W. Smith, C. C. Calvert, and J. R. Menear.

In: Proceedings 1973 Maryland Nutrition Conference for Feed Manufacturers, The University of Maryland, The Maryland Feed Industry Incorporated, and The American Feed Manufacturers Association cooperating, March 15-16, 1973. p 35-44, (1973), 1 fig, 15 tab, 14 ref.

Descriptors: \*Farm wastes, \*Arsenic, \*Sheep, \*Nitrogen, \*Feeds, Growth, Nutrition, Chemical properties, \*Recycling.

Identifiers: Poultry manure supplemented diets, Feed additives, Digestibility, Soybean oil meal.

Despite possible arsenical residues, dehydrated poultry-manure (DPM) supplemented diets were consumed by sheep as readily as diets supplemented with soybean oil meal (SBOM). Nitrogen from broiler manure supplemented diets was not significantly less digestible than SBOM nitrogen and was retained in the sheep equally well. The true digestibility of DPM-N was determined to be 81%, a value of similar magnitude determined by others for drymixed conventional feeds. Arsenic from different sources ingested by sheep was detected in all tissues assayed. Withdrawal of arsenic from feed results in a rapid decrease in tissue arsenic concentration. Significance of arsenic in poultry manure processed for ruminant crude protein supplements will depend on individual feeding regimes, arsenic concentration in manure and permissible levels established for lamb and mutton. (East Central)

W74-00413

#### EFFECT OF BACILLUS THURINGIENSIS IN CATTLE MANURE ON HOUSE FLY LARVAE, Agricultural Research Service, Beltsville, Md. Animal Science Research.

R. W. Miller, L. G. Pickens, and C. H. Gordon.

Journal of Economic Entomology, Vol 24, No 4, p 902-903, August 1971. 2 tab, 11 ref.

Descriptors: \*Cattle, \*Farm wastes, Larvae, \*Mortality, Additives, Feeds, Poultry.

Identifiers: \*Fly control, \*Bacillus thuringiensis Berliner, \*Musca domestica L., Biotrol BTB-183.

A commercial formulation of Bacillus thuringiensis Berliner, Biotrol BTB 183-25 W, was fed to dairy cattle in an attempt to control house fly, *Musca domestica* L., larvae in the feces. A maximum larval mortality of 32% was obtained when cows were fed 3200 ppm of this formulation. In an in vitro experiment, complete control of house fly larvae was obtained at a level of 12,800 ppm of feces. (East Central)

W74-00414

#### THE EFFECT OF RATION ON ENGINEERING PROPERTIES OF BEEF CATTLE MANURE, Nebraska State Dept. of Environmental Control, Lincoln. Solid Waste Div.

For primary bibliographic entry see Field 05B. W74-00420

#### MANURING OF POTATOES ON FEN SILT SOILS IN HOLLAND, LINCOLNSHIRE, Agricultural Development and Advisory Service, Cambridge (England).

For primary bibliographic entry see Field 03F. W74-00422

#### TOXICITY TO HOUSE FLIES AND HORN FLIES OF MANURE FROM INSECTICIDE FED CATTLE, Agricultural Research Service, Kerrville, Tex. Entomology Research Div.

R. O. Drummond.

Journal of Economic Entomology, Vol 56, No 3, p 344-347, June, 1963. 2 tab, 6 ref.

Descriptors: \*Toxicity, \*Farm wastes, Feed lots, Larvae, \*Insecticides.

Identifiers: \*House flies (*Musca domestica*), \*Horn flies (*Haematobia irritans*), Bayer 22408, Co-ral, Butonate, Bayer 37342, Famophos, Bayer 37341, Rhodia RP-9895, Dipterex, V-C 13, General Chemical 4072, Bayer 29493, Stauffer R-1504, Chlorinated hydrocarbons.

Insecticides were added to cattle rations in long and short term experiments. In a 91-day test Co-ral and Bayer 22408 proved 100% effective in preventing development of larvae of horn flies in the manure tested. Ten insecticides were used in 10-day tests. Some insecticides were effective against both species, while others were at least partially effective with either or both. (Frantz-East Central)

W74-00423

#### AGRICULTURE AND ENVIRONMENT,

For primary bibliographic entry see Field 05B.

W74-00427

#### FROM RESORT AREA TO URBAN RECREATION CENTER: THEMES IN THE DEVELOPMENT OF LAKE TAHOE 1946-1956, California Univ., Davis. Inst. of Governmental Affairs.

For primary bibliographic entry see Field 06B. W74-00441

#### WATERSHED PROGRAM LACKS ECOLOGICAL DIMENSIONS, For primary bibliographic entry see Field 06G. W74-00442

#### WISCONSIN'S SHORELAND PROTECTION PROGRAM: A STATE-LOCAL REGULATORY APPROACH TO NATURAL RESOURCE PRESERVATION, For primary bibliographic entry see Field 06E. W74-00447

## Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

#### SOLID WASTE MANAGEMENT.

Metropolitan Council of the Twin Cities Area, Minn.

March, 1970. 24 p, 2 fig.

Descriptors: \*Solid wastes, \*Water pollution, \*Landfills, Planning, Waste disposal, Environmental effects, Water table, Groundwater, \*Minnesota.

Identifiers: Policies, Solid waste management, \*St. Paul (Minn.), \*Minneapolis (Minn.).

This policy plan for solid waste management, one of several interrelated elements of a total development guide for the Twin City metropolitan area, contains three parts: a presentation and discussion of long range policies for solid waste management; a 10 year plan for disposal of solid wastes with emphasis on sanitary landfills; and a short range implementation program. The long range policies cover such issues as disposal methods, the location and accessibility of landfill sites, environmental pollution and relations to water resources, compatibility of disposal sites with adjacent land uses, and the ultimate use of the disposal site for other purposes. With regard to relations to environmental quality and water resources in particular, sanitary landfills are prohibited within 1,000 feet of the normal highwater mark of a lake, pond, or reservoir and within 300 feet of a river or stream; they are prohibited in major groundwater recharge areas and wetlands, and putrescible wastes cannot be deposited within five feet above the highest known level of the water table at a landfill site. (Elfers-North Carolina).

W74-00449

#### METROPOLITAN COUNCIL FIVE-YEAR CAPITAL IMPROVEMENT PROGRAM FOR SEWERAGE FACILITIES.

Metropolitan Council of the Twin Cities Areas, Minn.

September, 1972. 20 p, 2 tab.

Descriptors: \*Sewerage, \*Project planning, \*Budgeting, \*Minnesota, Programs, Projects, Priorities, Financing, Water quality control.

Identifiers: Capital improvements, Public participation, \*St. Paul (Minn.), \*Minneapolis (Minn.).

This program amends the 1970 Metropolitan Development Guide for sanitary sewers and includes numerous major projects for the collection, treatment, and disposal of wastewater for the period 1972 through 1976, a capital improvements budget for 1972-73, and various new policies and criteria. The program was formulated via well-defined procedures adopted by the Metropolitan Council to assure strong input from local governments and interested citizens. The procedures include public hearings, solicitation of written comments, and public meetings in each of the local sewer service areas. Some of the policies adopted include the new construction of only those projects for which maximum federal and state support is available and the expansion of sewerage capacity only where there is a strong local commitment, unless there are serious metropolitan-wide issues at stake. New criteria for ranking proposed projects were also adopted. Highest priority projects are those to serve areas subject to immediate health hazards, areas where serious pollution is taking place, and areas planned for major urban development within the next five years. (Eifers-North Carolina)

W74-00450

#### SEWAGE AND WASTE CONTROL RULES AND REGULATIONS FOR THE METROPOLITAN DISPOSAL SYSTEM.

Metropolitan Sewer Board, St. Paul, Minn.

December, 1971. 13 p.

Descriptors: \*Sewerage, \*Regulation, \*Waste water disposal, \*Waste water treatment, Waste identification, Inspection, Monitoring, Permits, Penalties, Standards, Septic tanks, Administration, \*Minnesota.

Identifiers: \*St. Paul (Minn.), \*Minneapolis (Minn.).

Rules and regulations have been adopted to provide an efficient and safe operation of the metropolitan wastewater disposal system and to help carry out the comprehensive sanitary sewer plan. The key areas covered by the regulations are new connections to the sewerage system, the nature of allowable discharges into the system, the disposal of septic tank sludge, and the enforcement of the regulations. No connections are allowed to the system without a permit and an inspection. Of particular importance is the determination of the source, quantity, and characteristics of the wastewater load. No connections are allowed to discharge contents from septic tank. Other wastes that are either prohibited or restricted include fats, wax, oils, garbage that has not been ground, radioactive wastes, and any materials that are either highly flammable or noxious. Industrial waste discharges are allowed but the industry must provide access to monitor the nature of the wastes. In addition, if the wastes are high in suspended solids or chemical oxygen demand a surcharge will be levied. (Eifers-North Carolina)

W74-00452

#### COMPREHENSIVE PLAN FOR BATON ROUGE.

Baton Rouge City-Parish Planning Commission, La.

For primary bibliographic entry see Field 03D.

W74-00453

#### CENTRAL FRESNO COUNTY WATER AND LIQUID WASTE PROGRAM: VOLUME I—FINDINGS, CONCLUSIONS, RECOMMENDATIONS.

Grunwald, Crawford and Associates, Inc., Fresno, Calif; and Engineering-Science, Inc., Fresno, Calif.

For primary bibliographic entry see Field 03D.

W74-00457

#### PUBLIC HEALTH CONSEQUENCES OF MASS SWARMING OF BOOPHTHORA ERYTHROCEPHALA (DE GEER, 1776) BLACK FLIES IN COUNTY SZOLNOK DURING FLOODS OF 1976,

Szolnok Megyei Kozegeszsegugyi Jarvanyugi Aljomas (Hungary).

D. Papay, J. B. Szabo, and I. Tarjanyi.

Parasitol Hung. 4 p 181-188. 1971. (English summary).

Identifiers: Boophthora-Erythrocephala, \*Flies (Black), Floods, Human diseases, \*Hungary (County Szolnok), Nuvan, \*Public health, Swarming, Chemtrol.

The black fly swarm in County Szolnok, Hungary in 1970 caused economic damage, with estimated losses approaching 1.0-1.5 million forints. These black flies, Boophthora erythrocephala, bred in large rivers and streams in Hungary. A total of 2600 persons received treatment for fly bites: of these 240 went on sick pay for a total of 1200 days. The illness lasted 5 days, but especially sensitive or seriously bitten people were sick for as long as 10 days. Chemical control of the flies was attempted by application of Nuvan 100 SC with a Tifa-system warm-fog generator. The complaints were finally eliminated overnight by the fall of the River Tisza and a period of hot weather.—Copyright 1973, Biological Abstracts, Inc.

W74-00477

#### CIESM AND MARINE POLLUTION,

Office of Naval Research, London (England).

For primary bibliographic entry see Field 05B.  
W74-00543

## 06. WATER RESOURCES PLANNING

### 6A. Techniques of Planning

#### METHODOLOGY FOR ASSESSING THE POTENTIAL IMPACT OF URBAN DEVELOPMENT ON URBAN RUNOFF AND THE RELATIVE EFFICIENCY OF RUNOFF CONTROL ALTERNATIVES,

Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.

For primary bibliographic entry see Field 02A.  
W74-00001

#### SYSTEMS ANALYSIS MADE EASY FOR WATER RESOURCES PLANNERS,

Montana State Univ., Bozeman. Dept. of Civil Engineering.

G. V. V. Rao, and T. T. Williams.

Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 36 p, 2 fig, 2 tab, 35 ref.

Descriptors: \*Water resources, \*Planning, \*Operations research, \*Linear programming, Optimization, Dynamic programming, Simulation analysis, Equations, Computer programs, Constraints, Reservoir operation, Model studies.

With technology enabling the impounding, lifting and transporting of water for so many uses, water resources planning is a highly complex task. Modern techniques of operations research can be gainfully used in solving such complicated problems. Techniques of operations research, particularly linear programming, are introduced, using examples taken from various water resource settings. Considered also are dynamic programming and simulation analysis. No previous knowledge of systems analysis is required. (Bell-Cornell)

W74-00167

#### FLOOD CONTROL MODEL FOR MULTI-RESERVOIR SYSTEMS,

Natal Univ., Durban (South Africa). Dept. of Civil Engineering.

For primary bibliographic entry see Field 04A.  
W74-00168

#### ESTIMATING REGIONAL WASTEWATER TREATMENT COSTS,

Wisconsin Dept. of Natural Resources, Madison. Water Resources Planning Section.

For primary bibliographic entry see Field 05D.  
W74-00169

#### THE DEVELOPMENT OF METHODS FOR THE PLANNING OF UTILISATION AND PROTECTION OF YUGOSLAV WATER RESOURCES.

B. Djordjevic.

Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 34 p, 2 fig, 9 ref.

Descriptors: \*Water resources development, \*Planning, \*Protection, \*Basins, \*Optimization, \*Multiple-purpose projects, Methodology, Hydrologic aspects, Legal aspects, Dynamic programming, Simulation analysis, Monte Carlo method, Equations, Mathematical models, Systems analysis.

Identifiers: \*Yugoslavia, Organizational aspects.

A general survey is presented of problems arising in planning the utilization and protection of water

## WATER RESOURCES PLANNING—Field 06

### Techniques of Planning—Group 6A

resources on a national scale and within individual basins. A brief illustration of the Yugoslav hydrological situation and the main water resource development problems is presented. Also given are the legal and organizational aspects of the complete system is described. The theory of the water resources development system is described through modern methods entailing a matrix with three vectors defining locations, quantities and quality of water resources. Special attention is paid to the problem of choosing criteria in solving optimization problems of complex systems, particularly treatment developmental, systematic-technical aspects of criterion selection. Cited are Monte Carlo-type methods used to simulate hydrological series in water resource development planning. The overall idea in the optimization of a complex, multiple-purpose system with the application of dynamic programming is illustrated, and experience collected to date in the solution of optimization problems in water resources development is summarized. (Bell-Cornell)

W74-00170

#### SCHEDULING AND SEQUENCING IN WATER RESOURCE INVESTMENT MODELS,

Cuyo Univ., Mendoza (Argentina). Escuela de Economica.

T. B. Facet, and D. H. Marks.

Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 35 p, 9 fig, 8 ref.

Descriptors: Water resources development, \*River basins, \*Investment, \*Mathematical models, \*Scheduling, \*Linear programming, \*Alternative planning, Optimization, Simulation analysis, Hydroelectric power, Irrigation, Systems analysis, Project planning constraints.

Identifiers: Integer programming, \*Sequencing.

Two methodologies are suggested for water resources investment planning, involving the use of optimization and simulation. Two optimization models are constructed: A scheduling linear programming and a sequencing integer programming model; both are utilized to obtain a preliminary selection of sites and operating strategies for development of a river basin. The objective is economic efficiency: given the planning objectives, available streamflows, and budget and population, what needs to be considered, and when, in order to maximize net revenues from the proposed projects. The linear programming model screens the whole range of development alternatives over time for a river basin; it is deterministic in that hydrologic inputs are taken as mean values and as being certain to occur, but since the model covers a certain time period, it is possible to investigate the sensitivity of the solution to different traces of inflows. The water uses considered are hydroelectric energy production and irrigation. The sequencing integer programming model is a type of capital budget model. It requires a set of possible projects to be built with specified sizes over the planning horizon. The problem is in what sequence to construct the selected projects. (Bell-Cornell)

W74-00172

#### WATER RESOURCE DEVELOPMENT PROBLEMS IN A RURAL AREA IN TRANSITION,

Montana State Univ., Bozeman. Dept. of Agricultural Economics.

C. Hash, and H. Holje.

Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 43 p, 1 tab.

Descriptors: Water resources development, \*Rural areas, \*Land development, \*Montana, \*Linear programming, \*Economic impact, Research, Estimating, Evaluation, Recreation, Irrigation water, Water distribution, Benefits, Agriculture, Systems analysis.

Identifiers: \*Bitterroot Valley (Montana), \*Multivariate regression analysis, Policy change, Residential use.

The rapid transition of land and water resources from agricultural to recreation-residential use in Montana's mountain valleys presents: opportunities for increased return to the resources of the area, and problems of possible local tax increases and other typical kinds of urban problems. Basic research findings of the Montana University Joint Water Resources Research Center are described. A multivariate regression model was used to analyze data on sales of unimproved tracts of land in the Bitterroot Valley area to determine the contribution to the value of various amenities and detriments. A linear programming model of the resource economy of the Valley was used to evaluate the impact on local community well-being of certain policies to internalize some of the external costs of recreation-residential development. It was estimated that an annual benefit of approximately \$63,000 could be realized by forcing developers and recreation-residential occupiers to consider and react to such externalities as the costs of: road maintenance, school transportation, and incompatible uses on adjacent lands. The linear programming model was used also to estimate the impact on the agricultural economy of improvements in the irrigation water distribution system. (Bell-Cornell)

W74-00173

#### DEVELOPMENT AND APPLICATION OF LARGE-SCALE WATER AND LAND ALLOCATION MODEL FOR THE UNITED STATES.

Iowa State Univ., Ames.

E. O. Heady.

Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 42 p, 8 fig, 2 tab, 10 ref.

Descriptors: \*United States, \*Water allocation (Policy), \*Water supply, \*Mathematical models, \*Regional analysis, \*Water users, Spatial distribution, Land use, Resource allocation, Prices, Crops, Value, Economics, Comprehensive planning, Human population, Evaluation, Equations, Systems analysis.

The development and application of large-scale water and land allocation models for the United States are summarized, and the basic mathematical programming model is presented in detail. This model considers the location of all population and economic activity in the future, water supplies in all water supply areas, all individual farm producing areas, all crops and livestock products of the U. S., and all consumer markets. It considers land restraints in each of 223 farm producing regions, water and irrigable land supplies (restraints) in each of 51 water supply regions, and a set of demand equations for food commodities in each of 50 spatially-defined consumer markets. This model determines: (1) an optimal spatial allocation of water between agriculture, industrial, and metropolitan uses, among many producing regions and among alternative potential water development projects; (2) supply price and value of water; (3) conditions under which capital technology should be developed for land used under rainfall conditions, and substituted for water at other locations. The model selects optimum combinations of irrigated and dryland crops under alternative technologies for each. This model, and many of those based upon it, are the largest, most detailed and operationally useful water planning models applied in any country in the world. (Bell-Cornell)

W74-00174

#### MATHEMATICAL MODELLING OF CAPACITY EXPANSION OF AN INTEGRATED HYDRO-THERMAL ELECTRICAL POWER SYSTEM,

Secretaria de Recursos Hidraulicos, Mexico City.

C. D. Howard.

Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 6 p, 1 fig.

Descriptors: \*Planning, \*Hydroelectric power, \*Simulation analysis, \*Mathematical models, Digital computers, Operating costs, Streamflow, Optimization, United States, Probability, Systems analysis, Thermal power.

Identifiers: \*Capacity expansion, Power demand, Manitoba (Canada).

A study to define development strategy consistent with the long-range capacity expansion required to meet an increasing power demand in Manitoba and a developing export market in the U. S. is described. The expansion problem was studied for several years by the System Planning Division of Manitoba Hydro, with the aid of a digital computer program allowing for simulation of most of the features of a possible ultimate system. The program simulated the operation of a power system at each stage of its development using historical streamflow sequences; results provided information about the probability of satisfying future power demands with the trial system configuration and the expected cost of operating the trial development plan over a 20-year period. Considering the complexity of selecting the optimal sequence of development of some 35 power stations, as well as of two major river diversions and two reservoir developments (all very large), and due to a five-month time constraint, it was deemed impractical to develop new, unproven mathematical techniques. Linear and non-linear programming did not appear as promising techniques here. Hence, a combination of a simplified mathematical model, Manitoba Hydro's detailed simulation program, and engineering judgment were utilized to approximate what an optimal system would look like. Particularly, the time and level of the next development stage were considered. (Bell-Cornell)

W74-00175

#### ROLE OF DIGITAL COMPUTER MODELS OF AQUIFERS IN WATER RESOURCES PLANNING: CASE STUDY IN TUCSON, ARIZONA,

Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.

For primary bibliographic entry see Field 04B.

W74-00176

#### JOINT USE OF SCREENING AND SIMULATION MODELS IN MULTIOBJECTIVE PLAN FORMULATION,

Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

For primary bibliographic entry see Field 06B.

W74-00177

#### EXPECTED OPTIMUM RECORD LENGTH AS A BASIS FOR HYDROLOGIC NETWORK DESIGN,

Geological Survey Washington, D.C. Water Resources Div.

For primary bibliographic entry see Field 07C.

W74-00178

#### OPTIMAL ALLOCATION OF LIMITED WATER RESOURCES,

Water Resources Engineers, Inc., Walnut Creek, Calif.

G. T. Orlob, I. P. King, D. E. Evenson, and G. K. Young.

Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 33 p, 9 fig, 1 tab, 4 ref.

Descriptors: \*Water allocation (Policy), \*Computer programs, \*Optimization, \*Planning, \*Water transfer, Texas, Simulation analysis, Water

## Field 06—WATER RESOURCES PLANNING

### Group 6A—Techniques of Planning

supply, Water demand, Inter-basin transfers, Decision making, Methodology, Evaluation, Systems analysis, Mathematical models. Identifiers: \*Cost minimization, \*Texas water plan, \*Poland (Vistula River System).

Some computerized techniques are described which have been designed specifically for water resource planners in determining the economically optimum program for stage development of large-scale water transfer schemes. Particular attention is paid to multi-component systems involving interbasin transfers from areas of surplus to locations of intensive demand. The Trans-Texas Division of the Texas Water Plan and the Vistula River System (Poland) are used as case studies to demonstrate application of the new methodology. The Texas study planning package: (1) determines reservoir operating rules using the Out-of-Kilter Algorithm; (2) uses a random search technique to select schedules and a method of successive perturbations to improve schedules and reduce costs; (3) uses a simulation-optimization model based on the OKA for a secondary screening of the development plans; and (4) final-screens the development plans to determine minimum-cost feasible solutions and optimal operating criteria. An extension of the OKA and a 'One-Step Method' that allows evaluation of alternative system configurations under optimal operating conditions were used in the Vistula River study; the general approach and the problems encountered are outlined. Potentials for future application of simulation-optimization techniques in planning for the allocation of limited water resources are discussed. (Bell-Cornell)  
W74-00179

**RELIABILITY OF URBAN WATER QUALITY MANAGEMENT,**  
Texas A and M Univ., College Station. Dept. of Industrial Engineering.  
For primary bibliographic entry see Field 05G.  
W74-00180

**STATE WATER RESOURCE PLANNING IN ARID ARIZONA,**  
For primary bibliographic entry see Field 06B.  
W74-00181

**RESERVOIR OPERATION FOR RECREATION USABILITY,**  
Toronto Univ. (Ontario). Dept. of Urban and Regional Planning.  
For primary bibliographic entry see Field 04A.  
W74-00185

**AGRICULTURAL WATER ALLOCATION, LAND USE, AND POLICY,**  
Iowa State Univ., Ames. Center for Agricultural and Rural Development.  
For primary bibliographic entry see Field 03F.  
W74-00186

**NEED FOR METROPOLITAN WATER BALANCE INVENTORIES,**  
American Society of Civil Engineers, Marblehead, Mass. Urban Water Resources Research Program. M. B. McPherson.  
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 99, No HY10, Proceedings paper No 10078, p 1837-1848, October 1973. 4 fig, 28 ref.

Descriptors: \*Water balance, \*Systems analysis, \*Municipal water, \*Comprehensive planning, Water resources, \*Management, \*International commissions, \*Water pollution, Engineering, Hydrology, Automation. Identifiers: \*Inventories, \*Urban development, Water budget, Metropolitan areas.

The term 'water balance inventory' is used to describe the determination of the quantity and quality aspects of the fate of water as it cycles through a metropolitan area. More of these inventories are needed for evaluation of the hydrological effects of urbanization and related development of strategies for resource management and environmental protection. A general accounting for the overall movement of water and pollutants can be ascertained by comparing such complete inventories over successive time intervals. The status of metropolitan comprehensive water resource systems analysis is outlined, system complexities are described, and the need for inventories is explained. (An inventory requires definition of the interrelationships between numerous processes and events, and this coincides with requirements for the initial stage of a comprehensive systems analysis of the water resources of a metropolitan area). Progress is being made in a few notable instances, but in most cases serious obstacles have impeded advances; investments in such research, world-wide, are well below levels that could be justified by the economic and environmental importance of urban water resources. (Bell-Cornell)  
W74-00187

**OPTIMIZATION OF MULTIPLE RESERVOIR SYSTEM,**  
California Univ., Los Angeles. Dept. of Engineering Systems.  
For primary bibliographic entry see Field 04A.  
W74-00188

**APPLICATIONS OF LINEAR INTEGER PROGRAMMING TO PROBLEMS OF LAND USE ALLOCATION,**  
Michigan Univ., Ann Arbor. School of Natural Resources.  
For primary bibliographic entry see Field 04A.  
W74-00503

### 6B. Evaluation Process

**STUDIES IN THE ANALYSIS OF METROPOLITAN WATER RESOURCES SYSTEMS, VOL. VI ESTIMATING ECONOMIES OF SCALE IN THERMAL ELECTRIC POWER SYSTEMS SUBJECT TO ENVIRONMENTAL QUALITY CONSTRAINTS,**  
Cornell Univ., Ithaca, N.Y.  
C. R. Scherer, and D. P. Loucks.  
Available from the National Technical Information Service as PB-224 500, \$8.00 in paper copy, \$1.45 in microfiche. Cornell University Water Resources and Marine Sciences Center, Ithaca, Technical Report No. 67, 1973. 376 p, 86 fig, 44 tab, 101 ref, 4 append. OWRR C-3101 (No 3684) (2).

Descriptors: Model studies, Optimization, \*Linear programming, Electric power rates, Long-term planning, Methodology, \*New York, \*Cost analysis, \*Electric power demands, Economic efficiency, \*Economics of scale, Utilities, Environmental effects, Thermal pollution, \*Water quality standards, Urbanization.

This study is concerned with the estimation of economies of scale in thermal-electric power systems subjected to water quality standards. The approach is engineering-economic. Mixed-integer programming is used to solve a mathematical model of a power system subject to constraints defining (1) the load duration curves of several demand centers located on a spatial grid or network, (2) endogenously determined reserves equal to the largest two generating units in the system, (3) nonlinear transmission losses, and (4) environmental quality and emission standards. The objective of the model is to minimize the sum of total capital and operating costs for generation, transmission

and abatement of pollution emissions. Fixed charges and piecewise linear functions are used to define costs exhibiting increasing returns to scale. The model is applied to a major part of the New York State Electric and Gas Corporation system. The results show that: (1) a system dominated by coal-fired new steam plants manifests increasing long-run average total system costs, no matter what emission controls are imposed on its plants, (2) a system dominated by nuclear-fueled new steam plants would manifest decreasing average costs, no matter what emission controls are imposed, (3) when emissions are limited to 'near-zero', average total costs increase only very slowly with system peak output for coal-dominated systems, but decrease very rapidly for nuclear-dominated systems. The ratio of system capital cost to system total costs increases as permissible emissions are decreased.  
W74-00002

**GEORGIA'S WATER PROBLEMS AND RELATED RESEARCH NEEDS,**  
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.

G. E. Wilcke, A. C. Benke, A. M. Lumb, B. H. Kornegay, and W. Neely.

Available from the National Technical Information Service as PB-224 433, \$4.25 in paper copy, \$1.45 in microfiche. Completion Report ERC-1173, August 1973. 100 p, 2 fig, 3 tab, 26 ref, 2 append. OWRR A-041-GA (1). 14-31-0001-3810.

Descriptors: \*Research priorities, \*Management, Local governments, \*Research facilities, \*Scientific personnel, \*Georgia, Irrigation, Ecology, Channeling, \*Planning, Hydrologic cycle, Pollution abatement, State governments, Education, Universities.

Water problems and research needs are discussed by region of the State. They are also discussed under the headings of water quantity, quality, ecology, planning and management, and agriculture. A survey of research capability in Georgia colleges is included. Technology transfer needs are addressed and related to research. Though a water-rich State, Georgia has a wide range of water problems, including floods, droughts, pollution, local water shortages, soil erosion, and conflicts over the use of land and water resources. The problems are shifting from predominantly rural to predominantly urban. Ecological studies throughout the State, groundwater studies in the Piedmont and Mountain regions, erosion reduction in areas undergoing urban development, drought studies, and a number of supplemental irrigation problems are among the research needs. Many of the research needs are in planning and management, particularly those dealing with land and water use conflicts. A large research capability exists in Georgia, both at the graduate education and research universities and at the two- and four-year college units of the University System of Georgia. Utilization of this capability is hampered by the lack of suitable organizational arrangements and of funds for working on problems that are primarily of interest within the State. A major deficiency in Georgia is the absence of a research tradition in water resources. A research board or council is recommended to foster such a tradition, to increase the rate at which needed research is done, and to help disseminate the results.  
W74-00004

**COASTAL PROCESSES AND LONG RANGE PLANNING,**  
Scripps Institution of Oceanography, La Jolla, Calif.  
For primary bibliographic entry see Field 02L.  
W74-00034

**REGIONAL PERSPECTIVES,**  
Tennessee Valley Authority, Chattanooga.  
For primary bibliographic entry see Field 05G.

## WATER RESOURCES PLANNING—Field 06

### Evaluation Process—Group 6B

W74-00123

#### PROCEEDINGS: LIVESTOCK WASTE MANAGEMENT RESEARCH REVIEW.

For primary bibliographic entry see Field 05G.  
W74-00125

#### REGIONAL ADMINISTRATOR'S SUMMARY,

Agricultural Research Service, Peoria, Ill. North Central Region.

H. M. Teeter.

In: *Proceedings: Livestock Waste Management Research Review*, Nebraska Center for Continuing Education, Lincoln, Nebraska, p 121-124, November 29-30, 1972.

Descriptors: \*Reviews, \*Planning, Project planning, \*Evaluation, Waste treatment, Farm wastes.

Identifiers: \*Program Planning Review.

Researchers should be required to do fewer reviews and reports that could be done through the Program Planning Review. The Program Planning Review plans and evaluates research programs and assesses the quality and effectiveness of research. (See also W74-00125) (Frantz-East Central)

W74-00142

#### ENERGY CONSERVATION STRATEGIES,

Environmental Protection Agency, Washington, D.C. Office of Research and Monitoring.

M. R. Seidel, S. E. Plotkin, and R. O. Reck.

Copy available from GPO Sup Doc as EPI.23/3:73-021, \$1.25; microfiche from NTIS as PB-224 493, \$1.45. EPA Socioeconomic Environmental Studies Series, Report EPA-R5-73-021, July 1973. 114 p, 10 fig, 20 tab. EPA Program Element 1H1093.

Descriptors: Energy, Demand, \*Alternative costs, Evaluation, Economic efficiency, \*Economic prediction, Pricing, Investment, \*Cost analysis, \*Estimated costs, Marketing, \*Resource allocation, Natural resources, Alternative planning.

Identifiers: \*Emergency demand, \*Price distortions, \*Energy uses, Energy conservation.

Various strategies are examined for reducing national energy demand. Suppose government chooses to reduce national energy use, and to do so in a cost-effective way. Then it is necessary to determine, for each potential energy saving, how much energy is involved and how costly the alternatives would be. The study begins by asking how much is now paid, or might be paid in the future, by various energy users. Many users get much of their energy at relatively low prices, and are thus encourage to waste it; the economist calls this 'price distortion', a form of 'market failure'. The study analyzes the kinds of market failure which seem to cause the present 'energy crisis', the kinds of government action which could rectify these failures, and the likely response of the economy to moderate price increases. Numerous actions, some large and some small, would be required to restore more efficient functioning of the market for energy. Some of these actions have already been initiated. In an efficient market, energy price increases of 25% would prompt a halving of the growth of energy demand; through 1990, energy needs would grow 40% rather than the 100% projected at current prices. (EPA)

W74-00152

#### ASSESSING THE SOCIAL EFFECTS OF PUBLIC WORKS PROJECTS,

Army Board of Engineers for Rivers and Harbors, Fort Belvoir, Va.

E. J. Baur.

Resident Scholar Program Research Paper No 3, June 1973. 35 p, append.

Descriptors: \*Social impact, \*Planning, \*Utilities, Forecasting, Indicators, Measurement, \*Social participation, \*Project planning, Project post-evaluation, \*Evaluation.

Identifiers: Social effects, Social indicators.

Social effects of public works projects should be viewed as resultants of interaction between agency and the public. Since the role the agency takes in this process is an important determiner of the outcome, the analysis of social effects must take account of the agency's public participation program. To avoid overlooking possible social effects, a complete list of social phenomena is needed. A systematic outline based on theoretical and empirical sources for inventorying social effects is presented. The identification and selection of phenomena for analysis that may be affected by a specific project must depend on the discernment of competent social scientists who are able to establish rapport with the public. The limitations of quantitative measurement methods requires supplementation by qualitative analysis. Where existing data sources are inadequate, the agency will need to use sample surveys and community studies. When forecasting effects, distinctions should be made between the stages of planning, construction, and operation. A continuing research program is recommended for determining the actual social effects of completed projects, developing improved methods of social research, and disseminating the substantive and methodological results of studies.

W74-00163

#### COST-EFFECTIVENESS OF WATER RESOURCES SYSTEMS DESIGN IN DEVELOPING COUNTRIES: CASE OF THE LOWER MEKONG,

Arizona Univ. Tucson. Dept. of Hydrology and Water Resources.

K. Chamsaithong, L. Duckstein, and C. Kisiel.

Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 23 p, 3 fig, 20 ref.

Descriptors: \*Cost analysis, \*Water resources development, \*Design, \*Methodology, \*Optimum development plans, Alternative planning, Decision making, Cost-benefit analysis, Cost-benefit ratio, Systems analysis, Evaluation, Fixed costs.

Identifiers: \*Cost-effectiveness, \*Lower-Mekong Basin, Developing countries, Sensitivity analysis.

Cost-effectiveness is an extension of engineering economics, in which alternative plans are sought and compared. Herein, the cost-effectiveness approach is introduced for analysis and design of water resource systems. The approach is used to study various possible alternative water resources systems and to identify the best systems for the desired goals in developing countries where the problems such as shortage of foreign currency, non-equilibrium of market conditions, unemployment, etc. generally exist. The standardized cost-effectiveness as proposed by Kazanowski is followed: (1) Define desired goals; (2) identify system requirements or specifications; (3) develop alternative systems for attaining desired goals; (4) establish systems evaluation criteria relating system capabilities to specifications; (5) select fixed-cost or fixed-effectiveness approach; (6) determine capabilities of alternative systems; (7) generate system versus criteria array; (8) analyze merits of alternative systems; (9) perform sensitivity analysis; and (10) document the rationale, assumptions and analyses underlying the previous steps. An example of the application of the approach in designing water resources systems in the Lower-Mekong Basin is presented. Classical methods of project analysis, such as cost-benefit analysis, are contrasted with the approach. Net benefit or the cost-benefit ratio are imbedded as one of the criteria in the fourth step of the cost-effectiveness procedure. (Bell-Cornell)

W74-00171

WATER RESOURCE DEVELOPMENT PROBLEMS IN A RURAL AREA IN TRANSITION, Montana State Univ., Bozeman. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 06A.

W74-00173

#### JOINT USE OF SCREENING AND SIMULATION MODELS IN MULTIOBJECTIVE PLAN FORMULATION,

Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

E. A. McBean, and J. C. Schaae, Jr.

Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 46 p, 20 fig, 25 ref, 3 append.

Descriptors: Water resources, \*Planning, \*Model studies, \*Simulation analysis, \*Linear programming, National income, Costs, Benefits, Hydrology, Optimization, Irrigation, Reservoirs, Systems analysis.

Identifiers: \*Screening models, \*Argentina (Rio Colorado), Regional income.

Water resources planning should consider relevant social objectives such as national economic development, environmental quality, social well-being, and regional development. Some multi-objective planning procedures and principles developed for water resources planning in Argentina are presented; the methodology was applied to a case study of the Rio Colorado. Because of the complexity of this river, this article creates a simple example to illustrate the central points of the methodology and its application in Argentina. The aim in plan formulation is to identify those alternatives which lie on or near the net benefit transformation surface. This search may be assisted by mathematical programming and simulation models, and the use of a linear programming screening model and simulation analysis is described. The basis for the joint use of screening and simulation models in multi-objective planning is illustrated. A screening model 'screens' out inferior alternatives by suggesting system configurations that would be optimal under certain assumed preferences for the system outputs; simulation models may be used to evaluate management and investment alternatives, and then used to estimate coefficients or parameters for screening models. (Bell-Cornell)

W74-00177

#### STATE WATER RESOURCE PLANNING IN ARID ARIZONA,

W. E. Steiner.

Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 16 p.

Descriptors: \*Water resources, \*Planning, \*Water supply, \*Arizona, \*Southwest U.S., \*Arid lands, Input-output analysis, Groundwater basins, Economics, Engineering, Water allocation (Policy), Evaluation, Costs, Water users, Water quality, Water quantity, Population, Growth, Systems analysis, Mathematical models.

Identifiers: Environmental impact, Residential development.

Arizona's demand for water exceeds the supply and, as the population continues to increase, it appears that the future forbodes an even greater imbalance. Three problems faced in Arizona and the planning approaches undertaken by state government are discussed. First, southwestern states must decide whether to submit costly augmentation of their available supplies or to live within the resources currently available and to modify use patterns and habits accordingly. Arizona proposes to develop plans for meeting each of these two alternative futures and to evaluate the costs and environmental impact for each plan. Second, the arid southwest faces problems in allocating amongst

## Field 06—WATER RESOURCES PLANNING

### Group 6B—Evaluation Process

competing uses and users. Arizona has utilized a computerized engineering systems approach which integrates an economic input-output model of the State's economy and engineering models of all water supply systems and the groundwater basins, to determine the allocation among users that would maximize the State's economy, minimize total water supply costs for all sources of water, and equalize groundwater declines to the extent practicable. And third, profligate development of new residential subdivision occurs in areas of severely limited water supplies. Before lot sales can commence in Arizona, the State must approve the adequacy of water supply for new subdivisions, regarding quality and quantity. (Bell-Cornell)  
W74-00181

**COST-EFFECTIVENESS ANALYSIS OF DISPOSAL SYSTEMS.**  
For primary bibliographic entry see Field 05E.  
W74-00184

**OPTIMIZATION OF MULTIPLE RESERVOIR SYSTEM.**  
California Univ., Los Angeles. Dept. of Engineering Systems.  
For primary bibliographic entry see Field 04A.  
W74-00188

**GROUND WATER RECHARGE, SOUTHERN REGIONAL DISTRICT, MONTGOMERY COUNTY, OHIO, ENGINEERING STUDY AND REPORT, PHASE I.**  
Moulambert and Seifert, Dayton, Ohio.  
For primary bibliographic entry see Field 04B.  
W74-00439

**FROM RESORT AREA TO URBAN RECREATION CENTER: THEMES IN THE DEVELOPMENT OF LAKE TAHOE 1946-1956.**  
California Univ., Davis. Inst. of Governmental Affairs.  
W. T. Jackson, and D. J. Pisani.  
Environmental Quality Series No 15. April, 1973.  
87 p, 2 fig.

Descriptors: \*Water supply, \*Sewage, \*Lake Tahoe, \*Public utilities, \*Recreation, Environmental effects, Public Utility District, Urban land use, History, \*California, \*Nevada.  
Identifiers: \*Resort community, Historical development.

Lake Tahoe's development as a resort center dates to 1924. After World War II, improved access by highway and air, development of winter sports facilities and an increase in residential building began to tax Tahoe City's water supplies. Controversy over public and private use of beaches, building and zoning codes, and land use occurred in the 1940's and 1950's. Small private utility companies supplied water between 1946-1956, many of these being absorbed into public utility districts as communities expanded. California and Nevada Departments of Public Health demonstrated considerable concern over sewage systems draining into the Lake and into the Truckee River, the natural outlet of the Lake. As pollution increased bond issues to provide a new sewage system at Tahoe City were defeated by voters and court actions became frequent. Conflict between those wishing to preserve and those wishing to develop the environment became evident. Attempts at bi-state cooperation over the water level controversy including the Truckee River Agreement which set maximum and minimum levels of the lake, and the proposed building of the Prosser Reservoir for storage by the Corps of Engineers, are traced. Problems of sewage disposal were also tackled on a bi-state basis often involving bitter conflict. Problems of jurisdiction and finance continue. (Edwards-North Carolina)  
W74-00441

#### SKIPACK WATERSHED AND THE EVANSBURG PROJECT: A CASE STUDY FOR WATER RESOURCES PLANNING, I. L. McHarg, and M. G. Clarke.

In: Environmental Quality and Water Development, W. H. Freeman and Co., San Francisco, 1973. C. R. Goldman, editor, p 299-330, 3 fig, 48 ref.

Descriptors: \*Water quality, \*Land use, \*Reservoirs, Methodology, \*Planning, Water supply, Pennsylvania, Regional Development, \*Pennsylvania.

Identifiers: \*Ecological planning approach, Skippack Watershed (Penn.), Montgomery County (Penn.), Evansburg Reservoir (Penn.), Urban growth.

An ecological approach to planning developed in a study of Skippack Watershed in Montgomery County, Pa., where a controversy emerged over a proposed state reservoir project. Models of uncontrolled growth indicate that in the next 15 years the watershed will change from a rural area on the fringe of suburbia to a rapidly developing suburban area. From an ecological perspective, the watershed is a composite of resources, offering gradations of opportunities and constraints for all land uses. Some conclusions were: the proposed Evansburg Reservoir would be quite eutrophic if present water quality were not significantly improved, the project would destroy significant remnants of the county's cultural heritage and there is no evidence that the project would be an economical solution to the region's water supply needs. A recommendation against its construction was thus made and an alternative of 2 intermediate recreation impoundments within an area for a state park suggested. Essence of the planning approach used is described including documentation of existing and anticipated urban growth to understand land-use demands; inventory of natural and cultural resources using a resource utilization matrix model to relate prospective land uses to the watershed's resources; kinds of cost and benefits considered varied with the specific resource and land use being evaluated; and evaluation of the environmental consequences of building the project. (Edwards-North Carolina)  
W74-00445

#### WATER DEVELOPMENT AND URBAN RECREATION, L. H. Scott.

In: Environmental Quality and Water Development, W. H. Freeman and Co., San Francisco, 1973. C. R. Goldman, editor, p 341-353, 6 ref.

Descriptors: \*Outdoor recreation, \*Recreation, \*Land use, \*Planning, \*Public access, Parks.

Identifiers: \*Waterfront, \*Shoreline, \*Intergovernmental coordination, \*Urban waterfront, Regional planning, Urban shorelines.

Policy recommendations made are: federal water development and conservation programs should be consolidated and coordinated; provision of public access should be made a condition of federal assistance programs in shoreline areas; environmental impact statements should consider potential for public access in each project; shoreline and coastal regulatory elements should be required in general, regional and state plans under state planning enabling legislation; private owners providing public access to shoreline should have tax relief; railroad rights-of-way that traverse city or county boundaries and shoreline areas should come under increased local jurisdiction; new federal assistance should be made available for purchase or less-than-fee easements to shorelines for public access; statutes controlling state port authorities should be amended to require public access in new projects; aid for transportation of poverty populations to distant water recreation facilities be considered; and that Model Cities programs be given 'Sign off' powers for all water development programs across federal agen-

cy lines to assure their input in these programs. Fragmented political jurisdictions, private industrial ownership of waterfront sites, conflicting land uses, and a lack of effective regional planning and institutions, have all contributed to limiting the realization of the potential of urban waterfronts for public use. A critical review is made of direct park acquisition, local general plans, zoning and subdivision ordinances, tax incentives, capital budgeting, urban renewal, and the Model Cities program, as they are concerned with providing public access and waterfront recreation sites. (Edwards-North Carolina)  
W74-00446

#### METROPOLITAN DEVELOPMENT GUIDE, WATER RESOURCES POLICY PLAN, PROGRAM.

Metropolitan Council of the Twin Cities Area, Minn.

May, 1973. 39 p, 2 fig.

Descriptors: \*Water resources, \*Surface drainage, \*Water supply, \*Water management, \*Comprehensive planning, Planning, Water resources development, Urbanization, Water demand, Groundwater, Non-structural alternatives, Runoff, Water quality control, \*Minnesota.

Identifiers: Water resource policies, \*St. Paul (Minn.), \*Minneapolis (Minn.).

The Metropolitan Council is directed by state law to prepare and adopt comprehensive development plans and policies for the Twin Cities metropolitan area. One element of this total development guide is the water resources policy plan. The policy plan is divided into three parts: a discussion of the general nature of water resources and related problems in the area; a long range policy plan which contains 31 specific policy recommendations and is intended to guide future development and public projects in directions to alleviate water resource problems; and a list of long and short term objectives and the agencies responsible to implement them. The emphasis of the policy plan is on water supply and surface water drainage. Although the area has abundant supplies of surface water the increasing demands for water will require careful management and an increasing use of groundwater. During low flow periods there are likely to be shortages of water for cooling water and waste assimilation. Low flow augmentation measures in cooperation with the Corps of Engineers are being considered. Surface water drainage is becoming a significant problem as urbanization increases runoff, degrades water quality, and reduces groundwater recharge. Various policies are proposed to handle these problems, e.g. floodplain management measures, restricted extension of water and sewer lines. (Elfers-North Carolina)

W74-00451

#### COMPREHENSIVE PLAN FOR BATON ROUGE.

Baton Rouge City-Parish Planning Commission, La.

For primary bibliographic entry see Field 03D.

W74-00453

#### NATIONAL ENVIRONMENTAL ANALYSIS, NASHVILLE-DAVIDSON COUNTY, TENNESSEE.

Metropolitan Government of Nashville-Davidson County, Tenn. Planning Commission.

For primary bibliographic entry see Field 03D.

W74-00455

#### PRELIMINARY REPORT OF PUBLIC UTILITIES ANALYSIS.

Janesville Div. of Public Works, Wis.

For primary bibliographic entry see Field 03D.

W74-00458

## WATER RESOURCES PLANNING—Field 06

### Water Law and Institutions—Group 6E

**MUDY CREEK DAM AND RESERVOIR, EMERY COUNTY, FEASIBILITY STUDY.**  
Rollins, Brown and Gunnell, Inc., Provo, Utah.  
For primary bibliographic entry see Field 08A.  
W74-00546

#### 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

**ESTIMATING REGIONAL WASTEWATER TREATMENT COSTS,**  
Wisconsin Dept. of Natural Resources, Madison.  
Water Resources Planning Section.  
For primary bibliographic entry see Field 05D.  
W74-00169

**DESIGN OF OPTIMAL SEWERAGE SYSTEMS,**  
Technion - Israel Inst. of Tech., Haifa.  
For primary bibliographic entry see Field 05D.  
W74-00183

**CAPITAL AND OPERATING COSTS OF POLLUTION CONTROL EQUIPMENT MODULES, VOLUME I, USER GUIDE,**  
ICARUS Corp., Silver Spring, Md.  
For primary bibliographic entry see Field 05G.  
W74-00307

**CAPITAL AND OPERATING COSTS OF POLLUTION CONTROL EQUIPMENT MODULES, VOLUME II, DATA MANUAL,**  
ICARUS Corp., Silver Spring, Md.  
For primary bibliographic entry see Field 05G.  
W74-00308

**METROPOLITAN COUNCIL FIVE-YEAR CAPITAL IMPROVEMENT PROGRAM FOR SEWERAGE FACILITIES.**  
Metropolitan Council of the Twin Cities Areas, Minn.  
For primary bibliographic entry see Field 05G.  
W74-00450

#### 6D. Water Demand

**WATER USE--COMMITTEE REPORT, PART II, REVIEW OF THE JOHNS HOPKINS UNIVERSITY RESEARCH PROJECT METHOD FOR ESTIMATING RESIDENTIAL WATER USE.**  
American Water Works Association, New York.  
Committee on Water Use.

Journal of American Water Works Association, Vol 65, No 5, p 300-301, May 1973. 1 illus.

Descriptors: Domestic water, \*Water demand, \*Use of water, Evapotranspiration, Utilities, Water requirements, Effective precipitation, Population density, Analytical techniques, Model studies, Planning, Research and development, Consumptive use, Public use.  
Identifiers: \*Residential water use.

A brief review is presented of a method developed by researchers at Johns Hopkins University for estimating residential water use. The project was sponsored by the Federal Housing Administration in cooperation with sixteen water utility companies. The applicability of the method developed as a practical tool for use by utility managers and engineers in estimating future residential average and peak flow requirements for particular communities is evaluated. The calculations made under the Johns Hopkins method require local data in the following areas: market value per dwelling unit, potential evapotranspiration, effective precipitation, and dwellings per acre. One serious problem with the method is that variation in market value in different sections of the country or changes in value due to inflation will result in a variation in

the calculated water use. Thus, a regional market valuation should be considered and this may present a large problem to a utility whose personnel are not normally qualified to conduct such an appraisal. While the Johns Hopkins method does represent a commendable effort to determine water use on a theoretical basis, more research and experience are required before its general application can be recommended. (See also W73-10741) (McKnight-Florida)  
W74-00121

**ENERGY CONSERVATION STRATEGIES,**  
Environmental Protection Agency, Washington, D.C. Office of Research and Monitoring.  
For primary bibliographic entry see Field 06B.  
W74-00152

**RESERVOIR OPERATION FOR RECREATION USABILITY,**  
Toronto Univ. (Ontario). Dept. of Urban and Regional Planning.  
For primary bibliographic entry see Field 04A.  
W74-00185

**AGRICULTURAL WATER ALLOCATION, LAND USE, AND POLICY,**  
Iowa State Univ., Ames. Center for Agricultural and Rural Development.  
For primary bibliographic entry see Field 03F.  
W74-00186

**DEMOGRAPHIC EFFECTS OF WATER DEVELOPMENT,**  
J. Hollis, and J. McEvoy III.

In: Environmental Quality and Water Development, W. H. Freeman and Co., San Francisco, 1973. C. R. Goldman, editor, p 216-232, 4 fig, 11 ref.

Descriptors: \*Water demand, \*Water supply, \*Urbanization, Population, Water resources, \*California.

Identifiers: \*Population distribution, \*Los Angeles, Consumption, Water-stimulated population growth.

From a demographic perspective the crux of the water problem in the U.S. lies in the discrepancy between the natural distribution of water supply and the distribution of consumers. Water use is increasing and projects are planned to meet the needs of an area in the foreseeable future, based on some projected or trend-based population likely to be overly optimistic. Construction of such projects usually insures that the projected population becomes a reality, so projects become both self-fulfilling and self-perpetuating especially for urban centers in semi-arid parts of the U.S. Three national demographic trends, relative to water demand and supply, are noted: absolute growth of population, the movement of people to the West, and increasing urbanization. There is an increasing tendency for population, especially urban, to increase in those parts of the country with the most meager water resources. Urbanization creates an intense, almost constant, demand for high quality water in a very small area, to be met largely by adjacent surface water. Implications of a coastal-urban distribution of population are that considerable sums must be spent to find and appropriate distant water supplies. Los Angeles is the best example of a city owing its economic and demographic growth to the skillful management of its water supply and the foresight of its water planners. It is recommended that the Federal Government establish a policy of carefully evaluating all population projections used as justification for water project proposals. (Edwards-North Carolina)

W74-00443

**CENTRAL FRESNO COUNTY WATER AND LIQUID WASTE PROGRAM: VOLUME I-FINDINGS, CONCLUSIONS, RECOMMENDATIONS.**

Grunwald, Crawford and Associates, Inc., Fresno, Calif; and Engineering-Science, Inc., Fresno, Calif.  
For primary bibliographic entry see Field 03D.  
W74-00457

#### 6E. Water Law and Institutions

**THE QUEST FOR WATER IN NEW MEXICO,**  
New Mexico Inst. of Mining and Technology, Socorro. Dept. of History.

P. W. Christiansen.

Available from the National Technical Information Service as PB-224 449, \$3.50 in paper copy, \$1.45 in microfiche. New Mexico Water Resources Research Institute La Cruces, Technical Completion Report 029, August 1973. 65 p, 188 ref. OWRR A-026-NMEX (1).

Descriptors: \*History, \*Water resources development, \*Irrigation systems, \*New Mexico, \*Water supply, Water control, Water utilization, Irrigation engineering, Water conveyance, Water users, Prior appropriation, Water wells, Farm management, Technology.

This study assembled historical data relating to water control and applied technology during Indian, Spanish, and Anglo-American periods in New Mexico. In addition, historic forces, such as law, social institutions, economic habits, irrigation practices, and transportation, affecting the development of water resources were laid out and evaluated, thereby giving a comparison of efforts and applications across the three major cultures making up New Mexico's historical pattern. The arid nature of New Mexico's climate forced all of its inhabitants, Indian, Spaniard, and Anglo-American alike, into maximum technical efforts toward water control. The Indian and the Spaniard tended to utilize similar techniques and generally practiced subsistence agriculture. Both Indian and Spanish villages have, by-and-large, clung to methods centuries old and have not had the opportunity or desire to utilize new scientific and technological advances. On the other hand, the Anglo-American settled in unoccupied areas, practiced commercial agriculture, and applied massive technology to water development. This heavy technical application in the major water courses resulted in important economic advances, but has also created serious problems which can only be solved by even more massive applications of technology. (Creel-New Mexico)  
W74-00006

**EDUCATION, ACTION AND REGULATORY PROBLEMS OF ANIMAL WASTE MANAGEMENT,**  
Nebraska Univ., Lincoln.  
For primary bibliographic entry see Field 05G.  
W74-00133

**PROBLEMS OF ANIMAL WASTE MANAGEMENT FROM THE LIVESTOCK FEEDER VIEWPOINT,**  
Nebraska Livestock Feeders Association, Fairmont. Environmental Management Committee.  
For primary bibliographic entry see Field 05G.  
W74-00134

**REGIONAL ADMINISTRATOR'S SUMMARY,**  
Agricultural Research Service, Peoria, Ill. North Central Region.  
For primary bibliographic entry see Field 05G.  
W74-00141

## Field 06—WATER RESOURCES PLANNING

### Group 6E—Water Law and Institutions

#### THE DEVELOPMENT OF METHODS FOR THE PLANNING OF UTILISATION AND PROTECTION OF YUGOSLAV WATER RESOURCES.

For primary bibliographic entry see Field 06A.

W74-00170

#### COST-EFFECTIVENESS OF WATER RESOURCES SYSTEMS DESIGN IN DEVELOPING COUNTRIES: CASE OF THE LOWER MEKONG.

Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.

For primary bibliographic entry see Field 06B.

W74-00171

#### SCHEDULING AND SEQUENCING IN WATER RESOURCE INVESTMENT MODELS.

Cuyo Univ., Mendoza (Argentina). Escuela de Economica.

For primary bibliographic entry see Field 06A.

W74-00172

#### TRANSFER OF WATER RESOURCES KNOWLEDGE.

For primary bibliographic entry see Field 10A.

W74-00189

#### ECONOMIC ANALYSIS AND MUNICIPAL WATER SUPPLY IN DEVELOPING COUNTRIES.

International Bank for Reconstruction and Development, Washington, D.C.

For primary bibliographic entry see Field 10A.

W74-00190

#### PUERTO RICO: A CASE STUDY OF WATER RESOURCE TECHNOLOGY TRANSFER,

Puerto Rico Dept. of Public Works, San Juan.

Area of Natural Resources.

For primary bibliographic entry see Field 10A.

W74-00197

#### TRANSFER OF KNOWLEDGE IN WATER RESOURCES FROM RESEARCH TO PRACTICE,

European Economic Commission, Geneva (Switzerland). Environment Div.

For primary bibliographic entry see Field 10A.

W74-00198

#### THE ROLE OF THE INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE IN THE TRANSFER OF WATER RESOURCES KNOWLEDGE,

Bureau of Reclamation, Denver, Colo. Technical Services Branch.

For primary bibliographic entry see Field 10A.

W74-00199

#### TECHNICAL AID FOR HYDROLOGIC STUDIES IN SPANISH-SPEAKING COUNTRIES,

Geological Survey, Lakeland, Colo.

For primary bibliographic entry see Field 10A.

W74-00202

#### WATER RESOURCES DEVELOPMENT POLICIES AND TRANSFER OF KNOWLEDGE FROM DEVELOPED TO DEVELOPING COUNTRIES,

Tahal Consulting Engineering Ltd., Tel Aviv (Israel).

For primary bibliographic entry see Field 10A.

W74-00206

#### WATER RESOURCES UTILIZATION IN DEVELOPING COUNTRIES,

Universidad Central de Venezuela, Caracas.

For primary bibliographic entry see Field 10A.

W74-00207

#### OBSTACLES TO CONSIDERATION OF RESOURCES MANAGEMENT ALTERNATIVES: SOUTH ASIAN EXPERIENCE,

For primary bibliographic entry see Field 10A.

W74-00208

#### TRANSFER OF WATER RESOURCES KNOWLEDGE FROM DEVELOPED TO DEVELOPING REGIONS OF THE WORLD,

Engineering Science, Inc., Berkeley, Calif., and

Engineering Science, Inc., McLean, Va. International Div.

For primary bibliographic entry see Field 10A.

W74-00209

#### KNOWLEDGE TRANSFER,

Utah State Univ., Logan. International Programs and Studies.

For primary bibliographic entry see Field 10A.

W74-00210

#### A CASE ON TRANSFER OF KNOWLEDGE IN WATER RESOURCES SYSTEMS PLANNING FROM A DEVELOPED REGION TO A DEVELOPING ONE, AND FROM RESEARCH

TO APPLICATION,

Chile Univ., Santiago. Faculty of Physical and Mathematical Sciences.

For primary bibliographic entry see Field 10A.

W74-00211

#### VENEZUELAN EXPERIENCE ON THE TRANSFER OF KNOWLEDGE IN WATER RESOURCES ENGINEERING,

Universidad Central de Venezuela, Caracas.

For primary bibliographic entry see Field 10A.

W74-00213

#### ACHIEVEMENTS OF INDIA IN THE FIELD OF WATER RESOURCES DEVELOPMENT,

Central Water and Power Commission, New Delhi (India).

For primary bibliographic entry see Field 10A.

W74-00214

#### EXPERIENCE OF THE U.S. GEOLOGICAL SURVEY IN TRANSFER OF HYDROLOGIC KNOWLEDGE TO THE DEVELOPING COUNTRIES,

Geological Survey, Washington, D.C. Office of International Activities.

For primary bibliographic entry see Field 10A.

W74-00215

#### SOME PROBLEMS ASSOCIATED WITH THE USE OF FOREIGN ADVISORS IN DEVELOPING COUNTRIES,

Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.

For primary bibliographic entry see Field 10A.

W74-00216

#### TRANSFER OF KNOWLEDGE IN WATER RESOURCES FROM DEVELOPED TO DEVELOPING REGIONS WITH SPECIAL REFERENCE TO THE CONDITIONS OF WEST PAKISTAN,

Ministry of Finance, Planning and Development, Islamabad (Pakistan). Div. of Water Resources.

For primary bibliographic entry see Field 10A.

W74-00217

#### DEVELOPMENT OF MATHEMATICAL MODELING CAPABILITIES FOR THE VISTULA RIVER PROJECT, POLAND,

Water Resources Engineers, Inc., Walnut Creek, Calif.

For primary bibliographic entry see Field 10A.

W74-00218

#### METHODS OF TRANSFER OF WATER RESOURCES KNOWLEDGE FROM DEVELOPED TO DEVELOPING REGIONS WITH SPECIAL EMPHASIS TO ON-FARM WATER MANAGEMENT,

Agency for International Development, Washington, D.C. Office of Agriculture and Fisheries.

For primary bibliographic entry see Field 10A.

W74-00219

#### GUIDELINES FOR TRANSFER OF PRACTICE TO APPLICATIONS FOR OPTIMUM ON PLANNING OF KEY ITEMS OF WATER RESOURCE PROJECTS,

Madhya Pradesh Government Control Board for Major Projects, Bhopal (India).

For primary bibliographic entry see Field 10A.

W74-00220

#### NEW FRONTIERS IN DRAINAGE AND RECLAMATION ENGINEERING IN THE INDUS PLAINS,

For primary bibliographic entry see Field 10A.

W74-00221

#### AN IHD PROJECT FOR TECHNOLOGY TRANSFER TO DEVELOPING REGIONS,

Hydrologic Engineering Center, Davis, Calif.

For primary bibliographic entry see Field 10A.

W74-00222

#### THE ROLE OF FAO IN THE TRANSFER OF WATER RESOURCES KNOWLEDGE TO DEVELOPING REGIONS,

Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.

For primary bibliographic entry see Field 10A.

W74-00223

#### TECHNICAL ACTIVITIES BY FAO IN THE TRANSFER OF WATER RESOURCES KNOWLEDGE TO DEVELOPING REGIONS,

Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.

For primary bibliographic entry see Field 10A.

W74-00224

#### TRANSFER OF KNOWLEDGE IN WATER RESOURCES POLICIES FROM DEVELOPED TO DEVELOPING COUNTRIES,

United Nations Water Resources Development Center, New York.

For primary bibliographic entry see Field 10A.

W74-00225

#### TRANSFER OF WATER RESOURCES KNOWLEDGE THROUGH THE UNITED NATIONS TECHNICAL ASSISTANCE ACTIVITIES,

United Nations Water Resources Development Center, New York.

For primary bibliographic entry see Field 10A.

W74-00226

#### RECENT DEVELOPMENT OF HYDROLOGICAL SERVICES IN COLOMBIA,

World Meteorological Organization, Bogota (Colombia).

For primary bibliographic entry see Field 10A.

W74-00227

## WATER RESOURCES PLANNING—Field 06

### Ecologic Impact of Water Development—Group 6G

**TRANSFER OF WATER RESOURCES KNOWLEDGE ASPECTS OF THE WORK OF THE UNITED NATIONS SYSTEM,**  
United Nations Educational, Scientific and Cultural Organization, Paris (France). Office of Hydrology.  
For primary bibliographic entry see Field 10A.  
W74-00228

**RULES, REGULATIONS AND MODES OF PROCEDURE, RELATING TO THE TEXAS WEATHER MODIFICATION ACT, V.A.T.S. WATER CODE, CHAPTER 14.**  
Texas Water Development Board, Austin.  
For primary bibliographic entry see Field 03B.  
W74-00357

**THE POLITICS OF WATER POLLUTION,**  
Connecticut Univ., Storrs. Inst. of Water Resources.  
For primary bibliographic entry see Field 05G.  
W74-00391

**WISCONSIN'S SHORELAND PROTECTION PROGRAM: A STATE-LOCAL REGULATORY APPROACH TO NATURAL RESOURCE PRESERVATION,**  
D. A. Yanggen.

In: Environmental Quality and Water Development, W. H. Freeman and Co., San Francisco, 1973. C. R. Goldman, editor, p 354-375, 2 fig, 9 ref.

Descriptors: \*Water quality control, \*Wisconsin, \*Regulation, \*Shore protection, \*Shores, \*Zoning. Identifiers: \*Shoreland protection, Shoreland Protection Law of 1966.

Under Wisconsin's Shoreland Protection Act of 1966, the state establishes minimum standards for local land use controls and retains the authority to adopt regulations if the local government fails to act. While a number of federal attempts have been made to establish the basis of national land use policy for protecting the environment and to encourage state action on land use planning and controls, only the Coastal Zone Management Act of 1972, concerned with coastal waters and adjacent shorelines, has become law. Nevertheless, a few states have acted to assert control over land uses affecting the environment, and among these is Wisconsin's Shoreland Protection Law of 1966 which is an attempt to protect the natural resource values of shorelands through a joint state and county regulatory effort. The statute sets out broad policy objectives of shoreland protection, special zoning objectives, directions for a state agency to prepare standards and criteria for local navigable water protection regulations, creates special shoreland corridors of 1000 foot depth for county zoning of unincorporated areas adjacent to navigable waters, and authorizes state level zoning on an unprecedented scale if counties fail to adopt adequate ordinances meeting minimum state standards. Essentially a natural resource oriented development code, regulations applying to all shoreland areas include minimum standards for water supply and waste disposal, tree-cutting controls, setbacks for structures from highways and navigable waters, minimum lot sizes, filling and grading limits, lagooning and dredging controls, and subdivision regulations. (Edwards-North Carolina)  
W74-00448

**METROPOLITAN DEVELOPMENT GUIDE, WATER RESOURCES POLICY PLAN, PROGRAM.**  
Metropolitan Council of the Twin Cities Area, Minn.  
For primary bibliographic entry see Field 06B.  
W74-00451

**RIVERS AND AMERICANS: A CENTURY OF CONFLICTING PRIORITIES,**  
For primary bibliographic entry see Field 06G.  
W74-00454

### 6F. Nonstructural Alternatives

**WISCONSIN'S SHORELAND PROTECTION PROGRAM: A STATE-LOCAL REGULATORY APPROACH TO NATURAL RESOURCE PRESERVATION,**  
For primary bibliographic entry see Field 06E.  
W74-00447

**CASE DESCRIPTION: MORRISON CREEK STREAM GROUP BASIN, CALIFORNIA,**  
M. S. Petersen.

In: Environmental Quality and Water Development, W. H. Freeman and Co., San Francisco, 1973. C. R. Goldman, editor, p 465-477, 2 fig, 2 append.

Descriptors: \*Flood control, \*Flood protection, Planning, Environmental effects, \*California, Land use, Floodways, Political aspects, Urbanization.

Identifiers: \*Public participation, \*Citizen involvement, Retardation basins, Morrison Creek Stream Group Basin.

In May, 1969, U.S. Corps of Engineers, Sacramento District, made public a tentative plan for flood protection and recreation in the Morrison Creek Group Basin. The nature of the basin and water related problems and the characteristics of the plan are presented. Conservation interests criticized the plan because wildlife habitat could feasibly be converted to urban use. The Corps expanded its planning process to include private interests and public agencies. Alternatives were developed and one selected with concurrence of Sacramento County, the local project sponsor. The alternative substituted a flood retardation basin in place of a leveed floodway. The author, a planner with the Corps, states: 'the Corps regarded the views expressed as legitimate criticism representing the position of large number of residents of the Sacramento metropolitan area. It was apparent that the Corps needed a clearer view of the preferences of citizens...' Public involvement techniques centered on limited public meetings and the establishment of a Citizens Environmental Advisory Committee. In an attempt to head off potential conflicts public sectors are now involved early in studies and continue to be present. (Edwards-North Carolina)  
W74-00448

### 6G. Ecologic Impact of Water Development

**REGIONAL PERSPECTIVES,**  
Tennessee Valley Authority, Chattanooga.  
For primary bibliographic entry see Field 05G.  
W74-00123

**WATERSHED PROGRAM LACKS ECOLOGICAL DIMENSIONS,**  
L. R. Jahn.

In: Environmental Quality and Water Development, W. H. Freeman and Co., San Francisco, 1973. C. R. Goldman, editor, p 183-195, 4 fig, 16 ref.

Descriptors: \*Small watersheds, \*Ecosystems, \*Degradation (Stream), Environmental effects, Conservation, Channel improvement, Land use, Wetlands.

Identifiers: Floodplain management.

Two of the most serious problems of the small watershed program involve maintaining valuable wetlands and streams and their associated shorelands and flood plains from inappropriate physical developments. Vast amounts of drainage, including channelization, have been applied in a detrimental manner leading to degradation and destruction of ecological systems, environmental quality, and public values. Outdated Congressional directives, misleading terminology, inadequate cost-benefit calculations and lack of independent ecological review have resulted in incomplete planning of projects. An ecological dimension must be incorporated into watershed planning and development. Immediate evaluation of watershed projects should include: post-construction investigations of the 273P.L. 566 watersheds completed by July, 1970 and upstream watersheds projects authorized through earlier enacted laws; reexamination of 1,288 watersheds approved for federal planning assistance; and pre-authorization evaluations of 8,904 small watersheds with problems as identified by the National Soil and Water Conservation Needs Inventory. State and federal resource agencies should inventory land and water resources in each proposed watershed project in sufficient detail to permit designation of important landscape features for maintenance and ecological management. Special concern should be given to protected stream sections, flood plains, wetlands, sites to hold excess runoff waters, and other unique features such as recharge areas. (Edwards-North Carolina)  
W74-00442

**MAN'S EFFECT ON THE GREAT LAKES,**  
For primary bibliographic entry see Field 04C.  
W74-00444

**RIVERS AND AMERICANS: A CENTURY OF CONFLICTING PRIORITIES,**  
R. Nash.

In: Environmental Quality and Water Development, W. H. Freeman and Co., San Francisco, 1973. C. R. Goldman, editor, p 78-94, 10 ref.

Descriptors: \*Water supply, \*Political aspects, \*Reservoir construction, \*California, Environmental effects, Conservation, Developed waters, History, Dams, Reservoir sites, Reservoirs.

Identifiers: San Francisco, \*Hetch Hetchy Valley (Calif), Yosemite National Park.

From 1905 to 1913, a controversy raged as to whether California's Hetch Hetchy Valley in Yosemite should remain inviolate as a national park or be used as a water supply reservoir for the needs of the city of San Francisco. The outline of the battle for development of Hetch Hetchy Valley is described. Ideas for such use for water supply and hydro-electric power—arose as early as 1882, although urgency and public sympathy for San Francisco's search for water increased with the earthquake and fire of 1906. Application for the use of the valley was approved by the Secretary of the Interior in 1908, however conservationists, especially John Muir, attempted to build Hetch Hetchy into a symbol of ethical and aesthetic qualities in opposition to its use. Because of strong opposition San Francisco's application died in the Sixteenth Congress. More debate and additional hearings preceded signature of the bill permitting development in December, 1913 by President Wilson. That the controversy occurred at all is held to be significant. Changes in public attitudes toward conservation occurred in the next half century and the burden of proof was placed on proponents of development. The Echo Park Dam controversy demonstrated the power of private citizen-action conservationist groups while intervention by conservationists resulted in Marbles and Bridge Canyon dams along the Colorado River not being built. New river development projects should be reviewed for their environmental impact. (Edwards-North Carolina)  
W74-00454

## Field 07—RESOURCES DATA

### Group 7A—Network Design

#### 07. RESOURCES DATA

##### 7A. Network Design

**EXPECTED OPTIMUM RECORD LENGTH AS A BASIS FOR HYDROLOGIC NETWORK DESIGN,**  
Geological Survey Washington, D.C. Water Resources Div.  
For primary bibliographic entry see Field 07C.  
W74-00178

**RESEARCH AND EDUCATION FOR DEVELOPMENT,**  
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 10A.  
W74-00212

**DRAINAGE AREAS OF TEXAS STREAMS, LAVACA RIVER BASIN.**  
Geological Survey, Austin, Tex.  
For primary bibliographic entry see Field 02E.  
W74-00548

##### 7B. Data Acquisition

**AN ELECTRONIC SENSOR AND CIRCUIT FOR AUTOMATIC OPERATION OF RAINFALL SHELTERS,**  
Mississippi State Univ., State College. Dept. of Agronomy.  
C. M. White, D. L. Myhre, and S. G. Williams.  
Agron J., Vol 64, No 6, p 847-849, 1972, Illus.  
Identifiers: \*Automation, \*Electronic equipment, Operations, \*Rainfall shelters, Sensors.

A simple, inexpensive, and durable electronic sensor for automatic operation of rainfall shelters for research plots is described. The advantages of the new circuit are: the very high input resistance overcomes problems associated with low conductivity of rainfall; the limited amount of current through the grid reduces corrosion; and the time delay prevents reversing of the shelters while in motion. Provision for heating the sensor grid prevents condensation of dew and hastens evaporation on cloudy days after rain stops.--Copyright 1973, Biological Abstracts, Inc.  
W74-00042

**MODIFICATION OF THE WAY OF READING THE VALUES OF RESISTANCE MEASURED BY MEANS OF THE PNEUMATIC SOIL RESISTANCE METER (PENETROMETER TYPE), (IN POLISH),**  
Instytut Uprawy Nowozienia i Gleboznawstwa, Pulawy (Poland).  
S. Tokarz.  
Pamiet Pulawski, 45, p 85-91, 1971, Illus, English summary.  
Identifiers: Measurement, Meters, Modification, Penetrometer, \*Pneumatic meters, \*Soil meters, Type.

A solution to the problem of recording the values of soil resistance to penetration, measured by means of Rzasa's pneumatic resistancemeter is presented. The results of measurements from the whole depth are recorded in graphic form. The use of recorder allows a reduction in the number of persons tending the apparatus from three to two to one. It also allows improvement of the exactness of measurements and the obtention of resistance values on the whole depth of the measurement.--Copyright 1973, Biological Abstracts, Inc.  
W74-00051

**USE OF THE MODEL T COULTER COUNTER IN SIZE ANALYSIS OF FINE TO COURSE SAND,**  
University of East Anglia, Norwich (England). School of Environmental Sciences.  
For primary bibliographic entry see Field 02J.  
W74-00103

**SETTLING BEHAVIOR RELATED TO SIEVE ANALYSIS OF SKELETAL SANDS,**  
Dundee Univ. (Scotland). Dept. of Geology.  
For primary bibliographic entry see Field 02J.  
W74-00105

**USE OF THE GAMMA FIELD OF THE EARTH TO DETERMINE THE WATER CONTENT OF SOILS,**  
Gosudarstvennyi Gidrologicheskii Institut, Lenigrad (USSR).  
For primary bibliographic entry see Field 02G.  
W74-00108

**RESULTS OF AN OPERATIONAL TEST OF M-100 RADIO-ELECTRONIC SNOW GAGES,**  
Gosudarstvennyi Gidrologicheskii Institut, Lenigrad (USSR).  
For primary bibliographic entry see Field 02C.  
W74-00109

**EFFECT OF AN ERROR IN THE DETERMINATION OF THE MAXIMUM WATER EQUIVALENT OF SNOW IN A BASIN ON THE FORECAST ACCURACY OF THE SPRING FLOOD VOLUME,**  
Gosudarstvennyi Gidrologicheskii Institut, Lenigrad (USSR).  
For primary bibliographic entry see Field 02C.  
W74-00110

**WATER POLLUTION,**  
Geological Survey, Washington, D.C.  
For primary bibliographic entry see Field 05A.  
W74-00124

**APPLICATION OF HIGH-SPEED LIQUID CHROMATOGRAPHY TO ORGANIC MICROANALYSIS. I. CONSTRUCTION OF A SIMPLE AND INEXPENSIVE APPARATUS,**  
City Univ. of New York.  
For primary bibliographic entry see Field 02K.  
W74-00249

**VOLTAMMETRIC DETERMINATION OF NITRATE AND NITRITE IONS USING A ROTATING CADMIUM DISK ELECTRODE,**  
Iowa State Univ., Ames. Dept. of Chemistry.  
For primary bibliographic entry see Field 02K.  
W74-00251

**ULTRATRACE ANALYSIS (BELOW P.P.B.) BY COUPLING CENTRIPETAL THIN-LAYER CHROMATOGRAPHY AND GAS CHROMATOGRAPHY,**  
Ceskoslovenska Akademie Ved, Brno. Ustav Instrumentalni Analyticke Chemic.  
For primary bibliographic entry see Field 05A.  
W74-00255

**ON THE QUANTITATIVE DETERMINATION OF FREE CARBON DIOXIDE IN NATURAL WATERS, (ZUR QUANTITATIVEN BESTIMMUNG DER FREIEN KOHLENSAURE IN NATURLICHEN WASSERN),**  
For primary bibliographic entry see Field 02K.  
W74-00263

**COUPLING OF HIGH SPEED PLASMA CHROMATOGRAPHY WITH GAS CHROMATOGRAPHY,**  
National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.  
For primary bibliographic entry see Field 02K.  
W74-00271

**MULTIELEMENT INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS OF BIOLOGICAL MATERIALS,**  
Cornell Univ., Ithaca, N.Y. Dept. of Chemistry.  
For primary bibliographic entry see Field 02K.  
W74-00289

**IN SITU MEASUREMENT OF SEDIMENT SOUND SPEED DURING CORING,**  
Texas Univ., Austin. Applied Research Labs.  
For primary bibliographic entry see Field 02J.  
W74-00294

**SEA-SURFACE CIRCULATION, SEDIMENT TRANSPORT, AND MARINE MAMMAL DISTRIBUTION, ALASKA CONTINENTAL SHELF,**  
Alaska Univ., College. Inst. of Marine Science.  
For primary bibliographic entry see Field 02J.  
W74-00298

**METHODS OF KARST INVESTIGATION (METODY IZUCHENIYA KARSTA),**  
For primary bibliographic entry see Field 02K.  
W74-00345

**INVESTIGATION OF ICE MOVEMENT ON MOUNTAIN GLACIERS BY STEREOPHOTOGRAFOMETRY (ISSLEDOVANIYE DVIZHENIYA L'DA GORNYKH LEDNIKOV STEREOFOTOGRAFMETRICHESKIM METODOM),**  
For primary bibliographic entry see Field 02C.  
W74-00346

**BACTERIAL FLAGELLAR UNCOORDINATION AS A MONITOR FOR INDUSTRIAL POLLUTANTS,**  
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.  
For primary bibliographic entry see Field 05B.  
W74-00438

**A SIMPLE PRINCIPLE FOR DOSING APPARATUS IN AQUATIC SYSTEMS,**  
Umea Univ. (Sweden). Dept. of Ecological Zoology.  
B. E. Bengtsson.  
Arch Hydrobiol. Vol 70, No 3, p 413-415. 1972. Illus.  
Identifiers: Apparatus, Aquatic, \*Dosing apparatus, Toxicology.

A dosing apparatus for toxicological investigations was constructed. The working unit is driven by the diluting water and no other power supply is needed. The apparatus is easily built in a workshop and the price is remarkably low in comparison with most commercial dosing pumps.--Copyright 1973, Biological Abstracts, Inc.  
W74-00473

**APPLICATION OF ECOLOGICAL, GEOLOGICAL AND OCEANOGRAPHIC ERTS-1 IMAGERY TO DELAWARE'S COASTAL RESOURCES PLANNING,**  
Delaware Univ., Newark. Coll. of Marine Studies. V. Klemas.  
Available from NTIS, Springfield, Va., 22151, E73-10426 Price \$3.00 printed copy; \$1.45 microfiche. Contract report to Goddard Space Flight Center, March 29, 1973. 6 p, 4 ref.

## RESOURCES DATA—Field 07

### Evaluation, Processing and Publication—Group 7C

Descriptors: \*Remote sensing, \*Aerial photography, \*Satellites (Artificial), \*Vegetation, \*Delaware River, Bays, Estuaries, Tides, Salinity, Turbidity, Data collections, Sampling, Correlation analysis, Coasts, Marshes.  
Identifiers: \*Delaware Bay area.

Imagery from four successful ERTS-1 passes over the Delaware Bay and Atlantic Coastal Region have been evaluated to determine visibility of aquatic features. The overpasses took place on August 16, October 10, December 3, 1972, and January 26, 1973. Visual inspection, density slicing and multispectral analysis of the imagery revealed strong suspended sediment patterns and several distinct types of aquatic interfaces or frontal systems. Measurements from boats and photography from low altitude aircraft, performed before and during the satellite overpasses, permitted a limited degree of correlation between satellite and ground data on the type and quantity of suspended matter. Multispectral analysis of high altitude RB-57 and U-2 photographs indicated that five vegetation communities could be clearly discriminated from 60,000 feet altitude including (1) salt marsh cord grass (*Spartina alterniflora*), (2) salt marsh hay and spike grass (*Spartina patens* and *Distichlis spicata*), (3) reed grass (*Phragmites communis*), (4) high tide bush and sea myrtle (*Iva* species and *Baccharis halimifolia*), and (5) a group of freshwater fowl. (Woodard-USGS)  
W74-00540

### 7C. Evaluation, Processing and Publication

PROCESSING OF RESULTS OF OBSERVATIONS OF SPRING DISCHARGE,  
Ceskoslovenska Akademie Ved, Brno,  
Geograficky Ustav.  
For primary bibliographic entry see Field 02E.  
W74-00096

SYSTEMS ANALYSIS MADE EASY FOR  
WATER RESOURCES PLANNERS,  
Montana State Univ., Bozeman. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 06A.  
W74-00167

ROLE OF DIGITAL COMPUTER MODELS OF  
AQUIFERS IN WATER RESOURCES  
PLANNING: CASE STUDY IN TUCSON,  
ARIZONA,  
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.  
For primary bibliographic entry see Field 04B.  
W74-00176

EXPECTED OPTIMUM RECORD LENGTH AS  
A BASIS FOR HYDROLOGIC NETWORK  
DESIGN,  
Geological Survey Washington, D.C. Water Resources Div.  
M. E. Moss.  
Presented at: The International Symposium on the Planning of Water Resources, Mexico City, December 4-8, 1972. 21 p, 3 fig, 10 ref.

Descriptors: \*Hydrologic data, \*Design, \*Networks, \*Data collections, \*Simulation analysis, Operating costs, Optimization, Methodology, Water resources, Planning, Benefits, Evaluation, Parametric hydrology, Decision making, Systems analysis.  
Identifiers: \*Data evaluation, \*Bayesian estimation.

Water resources planning necessitates providing sufficient hydrologic data at each decision point on the planning horizon. Design of a data collection network can be based upon the worth of these data in the planning and design process. Two

methodologies for the evaluation of data worth, simulation and Bayesian estimation, are examined, and both are found to have some deficiencies as tools for network design. Attributes of each methodology are combined to define the expected optimum record length, which is an estimate of the length of record that maximizes expected net benefit derived from a decision that is deferred in order to collect additional data. Considered are the costs of operating the data collection system and the costs of delaying the decision. Alternate methods of attaining an equivalent expected optimum record length are discussed. Regional regression methods may suffice when the regional hydrologic data base is sufficient. Parametric modeling may also be used to extract the required hydrologic information from a combination of relatively short hydrologic records and more generally available long meteorologic records. (Bell-Cornell)  
W74-00178

OPTIMAL ALLOCATION OF LIMITED  
WATER RESOURCES,  
Water Resources Engineers, Inc., Walnut Creek, Calif.  
For primary bibliographic entry see Field 06A.  
W74-00179

WATER RESOURCES SCIENTIFIC AND  
TECHNICAL INFORMATION DISPLAY,  
STORAGE, AND RETRIEVAL,  
Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.  
For primary bibliographic entry see Field 10A.  
W74-00192

TRANSMITTING WATER RESOURCES INFORMATION BY A TIME-SHARE SYSTEM,  
New Mexico State Univ., University Park.  
For primary bibliographic entry see Field 10A.  
W74-00194

AN ON-LINE SPECTROPHOTOMETER FOR  
COLLECTION OF MANIPULATION OF ABSORBANCE SPECTRA,  
Georgia Univ., Athens. Dept. of Biochemistry.  
R. J. DeSa, and J. E. Wampler.  
Applied Spectroscopy, Vol 27, No 4, p 279-284, July/August, 1973. 5 fig, 1 tab, 6 ref. PHS-GM-16834-03.

Descriptors: \*Automatic control, \*Data collections, \*Laboratory equipment, \*Data transmission, \*Data processing, Spectrophotometry, Instrumentation, Digital computers.  
Identifiers: \*On-line systems, \*Absorption spectra, Ultraviolet spectrophotometry, Ultraviolet spectra, Absorbance, Spectral analysis.

A uv-visible recording spectrophotometer has been developed which uses an on-line general purpose digital computer and the optical train of a conventional double beam recording spectrophotometer. The computer controls all functions of the instrument and permits the collection and manipulation of high quality absorption spectra without the use of electronic or optical correction devices. Spectra are represented by a series of up to 500 individual data points. Spectra can be manipulated in a variety of ways to meet particular experimental situations and can be displayed or plotted on an arbitrary absorbance scale. A spectrum can be added to, or subtracted from, any other spectrum, differentiated, converted to log absorbance, or multiplied by an arbitrary factor. Data can be preserved on paper tape or presented graphically as a high quality labeled plot of variable size on either a wave-length or a wave number scale. The complete system can scan a full spectrum at a maximum rate of 30 nm/sec over any part of a range from 230 to 700 nm. Details of the

system are presented with examples of its performance. (Little-Battelle)  
W74-00272

FLOODS IN JACKSON QUADRANGLE, MISSISSIPPI,  
Geological Survey, Washington, D.C.  
K. V. Wilson.  
Open-file atlas, 1 sheet, 1973. 5 fig, 1 photo, 1 map, 4 ref.

Descriptors: \*Floods, \*Flood data, \*Flood profiles, \*Flood frequency, \*Mississippi, Flood plains, Flood damage, Flood protection, Hydrologic data, Maps, Hydrographs.  
Identifiers: \*Jackson floods (Miss.), Atlas.

This one-sheet atlas presents hydrologic data that can be used to evaluate the extent of flooding that may be expected on Hanging Moss, Eubanks, Town, Lynch, Hardy, and Cany Creeks, and the Pearl River at Jackson, Miss. The technical information provided will aid in reaching decisions for sound economic management of flood-plain areas. The areas inundated by floods having a recurrence interval of 100 years are shown on a topographic map, with flood boundaries determined for 1972 channel conditions and conditions of urban development. Changed waterway openings at bridges and culverts, improved drainage systems, increased urbanization, retention structures, and other cultural changes may affect the boundaries of inundation by future floods. Also included are graphs showing flood frequency and flood profiles. (Woodard-USGS)  
W74-00302

QUALITY OF SURFACE WATERS OF THE  
UNITED STATES, 1968: PART 2. SOUTH ATLANTIC SLOPE AND EASTERN GULF OF  
MEXICO BASINS,  
Geological Survey, Washington, D.C.  
For primary bibliographic entry see Field 02K.  
W74-00303

ORGANIC POLLUTANT IDENTIFICATION  
UTILIZING MASS SPECTROMETRY,  
Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.  
For primary bibliographic entry see Field 05A.  
W74-00309

DIGITAL SIMULATION AND PROJECTION OF  
WATER-LEVEL DECLINES IN BASALT  
AQUIFERS OF THE ODESSA-LIND AREA,  
EAST-CENTRAL WASHINGTON,  
Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 02F.  
W74-00326

DIGITAL MODEL OF THE HYDROLOGIC  
SYSTEM, NORTHERN HIGH PLAINS OF  
COLORADO—A PRELIMINARY REPORT,  
Geological Survey, Denver, Colo.  
For primary bibliographic entry see Field 02F.  
W74-00330

STREAM GAUGING INFORMATION, AUSTRALIA—SUPPLEMENT 1971,  
Australian Water Resources Council, Canberra.

Australia Government Publishing Service, Canberra, 1973. 43 p.

Descriptors: \*Gaging stations, \*Flow measurement, \*Streamflow, \*Network design, \*Australia, Stream gages, Sites, Indexing, Drainage area, Data collections.

This publication is the second supplement to Stream Gauging Information, Australia,

## Field 07—RESOURCES DATA

### Group 7C—Evaluation, Processing and Publication

December 1969, the first supplement being entitled Stream Gauging Information, Australia, Supplement 1970. It contains details of changes and additions made in the stream-gaging network during the 12 months period ending December 31, 1971. Two more supplements will be issued until a revised catalog, based on data as of December 31, 1974, is published. During 1971, 156 new stream-gaging stations were established, 37 were discontinued and 4 were reestablished. Seven gaging stations, which had previously been omitted, are included in the supplement. This increase of 130 brings the total number of gaging stations in operation on December 31, 1971 to 2,535. (Woodard-USGS)  
W74-00350

**TROPICAL CYCLONE PRECIPITATION IN NEW JERSEY,**  
Rutgers—The State Univ., New Brunswick, N.J.  
Dept. of Meteorology.  
For primary bibliographic entry see Field 02B.  
W74-00435

**APPLICATIONS OF LINEAR INTEGER PROGRAMMING TO PROBLEMS OF LAND USE ALLOCATION,**  
Michigan Univ., Ann Arbor. School of Natural Resources.  
For primary bibliographic entry see Field 04A.  
W74-00503

**A METHOD FOR DETERMINING THE BEHAVIOR OF LONG WAVES CLIMBING A SLOPING BEACH,**  
North Carolina State Univ., Raleigh Dept. of Civil Engineering.  
For primary bibliographic entry see Field 02G.  
W74-00515

**ENTHALP, A COMPUTER PROGRAM FOR THE CALCULATION OF AQUIFER CHEMISTRY IN HOT-WATER GEOTHERMAL SYSTEMS,**  
Geological Survey, Menlo Park, Calif. Geologic Div.  
For primary bibliographic entry see Field 02F.  
W74-00532

**RECONNAISSANCE OF THE WATER RESOURCES OF BEAVER COUNTY, OKLAHOMA,**  
Geological Survey, Washington, D.C.  
R. B. Morton, and R. L. Goemaat.  
For sale by USGS, Washington, D.C. 20242, price \$1.25 per set. Hydrologic Investigations Atlas HA-450, 1973. 3 sheets, 7 fig, 4 map, 1 tab, 18 ref.

Descriptors: \*Water resources, \*Groundwater resources, \*Streamflow, \*Water quality, \*Oklahoma, Hydrogeology, Water wells, Aquifer characteristics, Water yield, Water utilization, Irrigation, Groundwater movement, Water level fluctuations, Groundwater recharge, Chemical analysis, Maps, Hydrographs, Hydrologic data. Identifiers: \*Beaver County (Okla).

Groundwater is the major source of water supply in Beaver County, Okla. Because of the rapidly increasing demand for the limited supply of water for irrigation, geologic data are presented to aid in the management of groundwater resources. This 3-sheet atlas presents general information on the availability of groundwater, on the chemical quality of water, and on streamflow. The chemical quality of water generally is poorer than that of water elsewhere in the Oklahoma Panhandle, and the ability to obtain good quality water may become increasingly difficult as the water resources are developed. The Ogallala Formation is the dominant surficial deposit and principal aquifer in Beaver County. The Ogallala is relative-

ly thin in the county, and is breached in many places, particularly along tributaries of the Beaver River. Where streams have eroded the Ogallala, the underlying Permian red beds crop out in elongate patterns paralleling the stream channels. The greatest depth to water is about 225 feet below land surface in the southwestern part of the county near Gray. The shallowest water is less than 25 feet deep along the largest streams such as Kiowa Creek and the Beaver and Cimarron Rivers. The dissolved-solids concentrated in water from the Ogallala ranges from approximately 150 to 600 mg/liter. The largest streams in the county are the Cimarron and Beaver Rivers. Water flows in the Cimarron all of the year whereas the Beaver is dry one or more months during the year. (Woodard-USGS)  
W74-00534

**FLOOD OF JUNE 1972 AT ELMIRA, NEW YORK,**  
Geological Survey, Washington, D.C.  
K. I. Darmer, and L. A. Wagner.  
Available from USGS, Washington, D.C. 20402, Price \$0.75. Hydrologic Investigations Atlas HA-518, 1973. 1 sheet, 5 fig, 1 map, 1 photo.

Descriptors: \*Floods, \*Flood data, \*New York, Maps, Hydrographs, Streamflow, Gaging stations, Flow rates, Peak discharge, Rainfall, Runoff, Flood profiles, Flood frequency, Flood peak, Historic floods, Hydrologic data. Identifiers: \*Elmira (NY).

This one-sheet atlas describes the greatest flood disaster in the history of New York which occurred during late June 1972 as a result of torrential rains brought by the remnants of Tropical Storm Agnes. The city of Elmira, in southwest-central New York, sustained the most extensive flooding of any populated area in the flood zone of New York. Flooding was primarily due to Chemung River, but Newtown Creek and Seeley Creek also experienced high flows. On June 23, 1972, the Chemung River at the Chemung gaging station crested at a stage of 31.62 feet corresponding to an elevation of 810.25 feet above mean sea level (discharge 189,000 cfs). The previous maximum stage at this station was 23.97 feet corresponding to an elevation of 802.60 feet above mean sea level (discharge 132,000 cfs) on May 28, 1946. Data presented in graphs include: cumulative precipitation from June 16 to 26, 1972, at Alfred and Elmira; annual floods above gage height 19.0 feet, 1904-72, Chemung River at Chemung; flood-frequency curve for Newtown Creek at Elmira, 1938-71; flood-frequency curve for Chemung River at Chemung 1904-71; and profile of floods of June 1972 and May 1946, Chemung River from Elmira to Chemung. (Woodard-USGS)  
W74-00535

**GEOHYDROLOGY OF DONIPHAN COUNTY, NORTHEASTERN KANSAS,**  
Geological Survey, Washington, D.C.  
C. K. Bayne.

For sale by USGS, Washington, D.C. 20242, Price \$0.75. Hydrologic Investigations Atlas HA-462, 1973. 1 sheet, 1 fig, 6 map, 1 tab, 13 ref.

Descriptors: \*Groundwater resources, \*Aquifer characteristics, \*Water wells, \*Water quality, \*Kansas, Hydrogeology, Geology, Water utilization, Water yield, Maps, Hydrologic data, Water table. Identifiers: \*Doniphan County (Kans).

This one-sheet atlas describes the groundwater resources of Doniphan County, the northeastern most county in Kansas. Reports describing the water resources of the area contiguous to Doniphan County are listed in the selected references. The locations of wells and test holes are identified according to the Federal system of land subdivision shown by a well-numbering

system diagram. Adequate supplies of water for domestic and stock use generally are available from wells in the glacial deposits underlying the upland areas of Doniphan County. Adjacent to the major streams, the alluvial deposits are then or have been removed by erosion. In these localized areas, small supplies of water are available from wells drilled into bedrock aquifers. Large supplies of water are available only from wells in alluvial deposits in the Missouri River valley. The groundwater is hard or very hard but may be rendered soft by simple treatment. Water from wells in the Missouri River valley and in some tributary valleys is very high in iron content. Water containing excessive amounts of nitrate occurs locally in all the aquifers. (Woodard-USGS)  
W74-00536

**VARIATION OF THE LOW LEVEL WINDS DURING THE PASSAGE OF A THUNDERSTORM GUST FRONT,**  
Pennsylvania State Univ., University Park.  
For primary bibliographic entry see Field 02B.  
W74-00545

**RIVER MILE INDEX-SAN JOAQUIN RIVER, TULARE LAKE AND BUENA VISTA LAKE BASINS, CALIFORNIA.**  
Bureau of Reclamation, Sacramento, Calif. Mid-Pacific Regional Office.  
For primary bibliographic entry see Field 02E.  
W74-00549

**RIVER MILE INDEX-KLAMATH RIVER, PACIFIC SLOPE BASIN, CALIFORNIA-OREGON.**  
Pacific Southwest Inter-Agency Committee, Sacramento. Water Management Technical Subcommittee.  
For primary bibliographic entry see Field 02E.  
W74-00550

## 08. ENGINEERING WORKS

### 8A. Structures

**DESIGN OF OPTIMAL SEWERAGE SYSTEMS,**  
Technion - Israel Inst. of Tech., Haifa.  
For primary bibliographic entry see Field 05D.  
W74-00183

**HOW ENGINEERING RESEARCH IS REDUCED TO PRACTICE IN THE BUREAU OF RECLAMATION,**  
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.  
For primary bibliographic entry see Field 10A.  
W74-00200

**RESEARCH FINDINGS AND THE DESIGN ENGINEER,**  
Auburn Univ., Ala.  
For primary bibliographic entry see Field 10A.  
W74-00201

**CASE DESCRIPTION: MORRISON CREEK STREAM GROUP BASIN, CALIFORNIA,**  
For primary bibliographic entry see Field 06F.  
W74-00448

**BEACH NOURISHMENT FROM OFFSHORE SOURCES,**  
Gee and Jenson Construction Engineers, Inc., West Palm Beach, Fla.  
For primary bibliographic entry see Field 02J.  
W74-00522

ENGINEERING WORKS—Field 08  
Fisheries Engineering—Group 81

**MUDY CREEK DAM AND RESERVOIR,  
EMERY COUNTY, FEASIBILITY STUDY.**  
Rollins, Brown and Gunnell, Inc., Provo, Utah.

Available from NTIS, Springfield, Va. 22152 as COM 73-10385 Price \$3.00 printed copy; \$1.45 microfiche. Report proposed for Utah Division of Water Resources, Salt Lake City, August 1971. 26 p., 15 fig., 13 tab.

Descriptors: \*Dam design, \*Water resources development, \*Water supply, \*Utah, Reservoirs, Flood control, Water utilization, Engineering structures, Costs, Economics, Irrigation, Recreation, Surveys, Hydrologic data, Planning, Projects, Evaluation.

The physical feasibility of constructing a dam and reservoir on Muddy Creek in Emery County, Utah, to be used to store water for irrigation of 8,066 acres of land on 67 farms is discussed. The project, when built, will include multipurposes such as fishing, waterborne recreation, flood control, soil conservation, and water-quality improvement. This investigation is sufficiently detailed to assure that a dam and reservoir can be constructed at an approximate cost of \$1,600,000 and benefits, direct and indirect, substantially exceed the cost. This project would be in keeping with the goals and guidelines established by the State Board of Water Resources, which include the enhancement of life for rural areas of Utah, and the more efficient use of Utah's limited water supply. Pertinent information and data include: geology, climate, land classification, land use, land ownership, water rights, water supply, water quality, water requirements, water development plan, flood protection, and dam design. (Woodard-USGS) W74-00546

## 8B. Hydraulics

**NAVIGATION CONDITIONS AT CONFLUENCE  
OF ARKANSAS, VERDIGRIS, AND GRAND  
RIVERS,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.

J. J. Franco, and C. D. McKellar, Jr.

Available from NTIS, Springfield, Va., 22151, as AD-757 598, \$3.00 in paper copy, \$1.45 in microfiche. Technical Report H-73-2, March 1973. 31 pl., 9 photo., 32 plate, 1 tab.

Descriptors: \*Channel improvement, \*Navigation, \*Model studies, \*River training, \*Oklahoma, Engineering structures, Hydraulic models, Harbors, Dredging, Locks, Dams. Identifiers: \*Arkansas River (Okla), Shoaling effects.

The development of an adequate navigation channel was investigated for the reach of the Arkansas River from the mouth of the Verdigris River downstream to below the new U.S. Highway 62 Bridge, as part of the Arkansas River multipurpose project. A movable-bed model reproducing about 5.7 miles of the Arkansas River in the Webbers Falls Lock and Dam pool, including the lower reaches of the Verdigris and Grand Rivers, to scales of 1:80 vertical and 1:120 horizontal was used for the study. The purpose was to develop a system of training structures that would reduce or eliminate shoaling at the confluence of the Verdigris and Arkansas Rivers, develop a channel through the navigation span of the new U.S. Highway 62 Bridge, and reduce the need for maintenance dredging in the Muskogee Harbor area, without producing currents that would be troublesome for navigation. Satisfactory navigation conditions will be provided with the plan developed, except that some shoaling might occur at the mouth of the Verdigris River during low Arkansas River flows and little or no flow in the Verdigris River. (Woodard-USGS) W74-00539

## 8C. Hydraulic Machinery

**ELECTRICAL POWER PLANT DRIVEN BY  
OCEAN WAVES AND TIDES,**  
J. Donatelli.

U. S. Patent No. 3,746,875, 5 p., 7 fig., 2 ref; Official Gazette of the United States Patent Office, Vol 912, No 3, p 1105, July 17, 1973.

Descriptors: \*Patents, \*Electric powerplants, Ocean waves, Tides, \*Tidal powerplants, \*Powerplants, Tidal energy, \*Generators, Electrical equipment. Identifiers: \*Floating platforms.

A floating platform is connected to a fixed structure which is mounted on the ocean floor. The platform is adapted to move with waves and tide. One generator is included which is driven by the up and down movement of the platform to generate electricity. The fixed structure is oriented to hold a landward edge portion of the floating platform towards a selected ocean shore and a seaward edge portion of the floating platform away from the selected shore. The platform is preferably constructed to slope from an elevated position above the water surface from both its seaward and landward edge portions toward its center, defining first and second paths of water flow. Other generating mechanisms, preferably including paddle wheels, are mounted across the first and second paths of flow to be driven by the water flowing therewith, thus generating electrical energy from the flow of waves and tides toward and away from the shore. A four-way electrical power plant is thus provided which operates to simultaneously generate energy from the up and down movement as well as from the two directional flow of ocean waves and tides towards and away from shore. (Sinha-OEIS) W74-00092

**DEMOLITION OF FT. MEADE DAM, STURGIS,  
SOUTH DAKOTA, JUNE 1972,**  
Army Engineer Waterways Experiment Station, Livermore, Calif. Explosive Excavation Research Lab.

For primary bibliographic entry see Field 08H. W74-00322

## 8D. Soil Mechanics

**LAKE OKEECHOBEE SEEPAGE MONITORING  
NETWORK,**  
Geological Survey, Tallahassee, Fla.

For primary bibliographic entry see Field 04A. W74-00337

**STABILITY CRITERIA FOR BOUND-ROCK  
EROSION PROTECTION,**  
Connecticut Univ., Storrs. Inst. of water Resources.

For primary bibliographic entry see Field 04D. W74-00390

## 8E. Materials

**HYDRAULIC TESTING ACCOMPANYING  
DRILLING OF FIVE EXPLORATORY HOLES,  
FICEANCE CREEK BASIN, COLORADO,**  
Geological Survey, Lakewood, Colo.

For primary bibliographic entry see Field 02F. W74-00299

## 8H. Rapid Excavation

**EFFECTS OF UNDERWATER DEMOLITION  
ON THE ENVIRONMENT IN A SMALL TROPICAL  
MARINE COVE,**  
Naval Underwater Systems Center, New London, Conn. New London Lab. For primary bibliographic entry see Field 05C. W74-00233

**DEMOLITION OF FT. MEADE DAM, STURGIS,  
SOUTH DAKOTA, JUNE 1972,**  
Army Engineer Waterways Experiment Station, Livermore, Calif. Explosive Excavation Research Lab.

B. B. Redpath. Available from NTIS, Springfield, Va. 22151 as AD-757 597; Price \$3.00 printed copy; \$1.45 Microfiche. Miscellaneous Paper E-73-1, January 1973. 12 p., 12 fig.

Descriptors: \*Flood damage, \*Dams, \*Explosives, \*Hydraulic engineering, \*South Dakota, Dam failure, Concrete dams, Rupturing, Reservoirs, Water levels, Pumping, Water pressure, Costs, Flood protection. Identifiers: \*Dam demolition, \*Ft. Meade Dam (S Dak).

A portion of a flood-weakened concrete and masonry dam was deliberately demolished by explosives in June 1972 near Rapid City, South Dakota. The demolition was carried out to forestall the possibility of the dam's collapse in the event of renewed flooding during the period of devastating floods in Rapid City. An 80- x 25-ft segment on the left abutment was cleanly removed by 3000 lb of explosives. The portion to be removed was outlined by explosively loaded 2-in. diameter holes on 1-ft centers, the reinforced concrete panels were broken up by seven 150-lb surface charges, and the broken material was ejected by a 1700-lb cratering charge emplaced in a cavity in the dam. All explosives were detonated simultaneously. The first step taken at the scene was to install several pumps to lower the water level, relieving the pressure on the dam. The work was accomplished in 4 days at a cost of perhaps \$10,000 and would have required a month and perhaps as much as \$50,000 if attempted with conventional construction equipment. (Woodard-USGS) W74-00322

## 8I. Fisheries Engineering

**EVALUATION OF COMMERCIAL FISHERY  
POTENTIAL OF WISCONSIN'S BOUNDARY  
WATERS OF LAKE SUPERIOR-WALLEYE,**  
Wisconsin Dept. of Natural Resources, Madison. B. Belonger, and R. Poff.

Available from NTIS, Springfield, Va. 22151 as COM-72-11165 Price \$3.00 printed copy; \$1.45 microfiche. Completion Report for NOAA, National Marine Fisheries Service, May 1971. 15 p., 10 fig., 4 tab. NOAA AFC-8.

Descriptors: \*Fish population, \*Walleye, \*Wisconsin, Rivers, \*Lake Superior, Tributaries, Fish migration, Census, Growth rates, Fish management, Tagging, Life cycles, Biology, Age, Ecology. Identifiers: Chequamegon Bay (Wisc.), Iron River (Wisc.), Bad River (Wisc.).

Two areas of walleye fish concentration in western Lake Superior (Chequamegon Bay-Bad River, and Superior-Iron River) were sampled. Mark and recapture methods were employed to assess migration, growth, and exploitation of their populations. The walleye population in the western Lake Superior study area has low commercial fishery potential because of the present sport fishery, the slow growth rate, and the long

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life span. Gill nets were lifted for 31 days with all fishing done during one-night outsets. The total catch was 858 walleye (including 12 tag returns—most of which were recaptured at or very near the point of tagging and within 5 days of tagging). Walleye size ranged in total length from 6.3 to 27.7 inches with 19.2 inches the median size for these fish captured in gill nets. Size distribution placed 93% of the walleye in the range of 17.0 to 21.9 inches. (Woodard-USGS)  
W74-00094

**THE ZOOPLANKTON OF A CARP POND UNDER CONDITIONS OF CONTINUOUS FILLING,**  
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.  
L. Krzeczkowska-Woloszyn.  
Acta Hydrobiol. Vol 14, No 3, p 307-315, 1972, Illinois.

Identifiers: \*Carp farms, Plankton, \*Poland (Golysz), Ponds, \*Zooplankton.

The effect of several years' filling of fish pond in Golysz (Cieszyn district) on the development of zooplankton was investigated. Seasonal variations and the influence of the fish stock on the quantity and qualitative composition of zooplankton are also discussed. The most intensive development of zooplankton was found in the first yr of the investigations, due to the first filling and utilization of the pond after its renovation. Permanent filling of the pond in the following years resulted in decreased amounts of zooplankton.—Copyright 1973, Biological Abstracts, Inc.  
W74-00099

**PARASITES, DISEASE, AND DISEASE CONTROL OF GREAT LAKES ANADROMOUS AND COMMERCIAL FISH,**  
Michigan Dept. of Natural Resources, Lansing.  
For primary bibliographic entry see Field 05C.  
W74-00229

**OCCURRENCE AND DISTRIBUTION OF HELMINTH PARASITES OF FISHES FROM LAKE CARL BLACKWELL, OKLAHOMA,**  
Oklahoma State Univ., Stillwater.  
For primary bibliographic entry see Field 05B.  
W74-00230

**SOME BIOLOGICAL ASPECTS OF CHANNEL CATFISH VIRUS DISEASE,**  
Auburn Univ., Ala.  
For primary bibliographic entry see Field 05C.  
W74-00231

**FRAZER LAKE SOCKEYE INVESTIGATIONS, 1970,**  
Alaska Dept. of Fish and Game, Kodiak. Research Section.  
P. A. Russell.  
Available from the National Technical Information Service as COM-73-10238. Alaska Department of Fish and Game Informational Leaflet No. 159, September 1972. 83 p, 32 fig, 15 tab, 11 ref, 11 append. 14-17-0005-222.

Descriptors: \*Fish migration, \*Spawning, \*Alaska, Timing, Smolt, Age, Fish management, Productivity, Fish reproduction, Fish establishment, Fish passages, Life history studies.  
Identifiers: \*Frazer Lake (Alaska), Kodiak (Alaska).

Research to assess the sockeye run at Frazer Lake, Kodiak Island, Alaska, from 1965 to 1970 is described. Smolt age composition in 1970 was 0.3% age 3.0, 31.6% age 2.0, 68.1% age 1.0 and 0.02% age 0.0. In 1970, age 0.0 smolt averaged 113 mm and 12 grams; age 1.0 smolt averaged 149 mm and 31 grams; age 2.0 smolt 180 mm and 54 grams;

age 3.0 smolt 193 mm and 64 grams. Sockeye freshwater survival from potential egg deposition to smolt indicates an overall median value for survival rate as about 0.70%. Smolt length frequency analysis provided a quantitative method of determining length distribution parameters usable in conjunction with scale reading to infer age composition of smolt outmigrations. Pilot echo sounding studies showed diurnal migration patterns of young sockeye. The number of sockeye entering Frazer Lake since 1956 has shown an increase with a peak return of 24,081 in 1970. Increase in sockeye spawner survival occurred in 1970 resulting from improved fishpass efficiency due to modifications and temporary lead construction. Limnological investigations included outlet temperatures and lake temperature profiles, plankton analysis, and a profile map of Frazer Lake. (Jones-Wisconsin)  
W74-00232

**LAKE HURON: EFFECTS OF EXPLOITATION, INTRODUCTIONS, AND EUTROPHICATION ON THE SALMOID COMMUNITY,**  
Department of Lands and Forests, Maple (Ontario). Research Branch.  
For primary bibliographic entry see Field 05C.  
W74-00244

**MILL CREEK FISH PASSAGE FACILITY,**  
Washington State Dept. of Fisheries, Olympia.  
R. W. Kramer.  
Available from NTIS, Springfield, Va., 22151 as COM-72-11081 Price \$3.00 printed copy; \$1.45 microfiche. Completion Report to NOAA, National Marine Fisheries Service, September 1970. 5 p, 6 photo. AFC-32.

Descriptors: \*Fish passages, \*Salmon, \*Hydraulic structures, \*Fish migration, \*Washington, Anadromous fish, Fish establishment, Fisheries, Fish reproduction, Spawning, Fish management, Waterfalls.  
Identifiers: \*Clallam County (Wash).

A fish passage facility was constructed through a falls in Mill Creek in Clallam County, Washington, in 1970 to open up 5 miles of spawning and nursery areas to coho salmon. Records of hatchery planting show that no salmon have been stocked in Mill Creek. In the summer of 1969, approximately 9 to 10 thousand coho fingerlings were salvaged from an adjacent dry stream channel and placed in this stream at several sites. Stocking of Mill Creek with coho salmon is anticipated to make use of the newly opened stream area. No chinook or other species of salmon are considered to be reared in this stream watershed. (Woodard-USGS)  
W74-00351

**THE DYNAMICS OF A GROUP OF PERCHES, PERCA FLAVESCENS (MITCHILL) IN THE GRANDE-ANSE COVE OF PERRON ISLAND IN SAINT-LOUIS LAKE, (IN FRENCH),**  
Montreal Univ. (Quebec). Dept. of Biological Sciences.  
For primary bibliographic entry see Field 02H.  
W74-00470

**SYNOPSIS ON THE BIOLOGY OF THE SHRIMP OF RIO DEL NORTE (CHILE), (IN SPANISH),**  
Chile Univ., Santiago. Departamento de Biología.  
For primary bibliographic entry see Field 02L.  
W74-00471

**ESTIMATION OF FISH PRODUCTION IN THE VOLGOGRAD WATER RESERVOIR, (IN RUSSIAN),**  
Gosudarstvennyi Nauchno-Issledovatel'skii Institut Ozernogo i Rechnogo Rybnogo Khozyaistva, Saratov (USSR).  
For primary bibliographic entry see Field 02H.

W74-00480

**ECOLOGICAL STUDIES ON THE PENAEUS ORIENTALIS KISHINOE CULTURED IN A POND FILLED WITH SEA WATER: I. GROWTH RATE AS RELATED TO THE SUBSTRATE MATERIALS, SURVIVAL RATE, PREDATOR OF *P. ORIENTALIS*, AND WATER CONDITIONS OF CULTURING POND,**  
Seoul National Univ. (Republic of Korea). Coll. of Education.

For primary bibliographic entry see Field 05C.  
W74-00486

## 09. MANPOWER, GRANTS AND FACILITIES

### 9A. Education (Extramural)

**GEORGIA'S WATER PROBLEMS AND RELATED RESEARCH NEEDS,**  
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.  
For primary bibliographic entry see Field 06B.  
W74-00004

**KNOWLEDGE TRANSFER,**  
Utah State Univ., Logan. International Programs and Studies.  
For primary bibliographic entry see Field 10A.  
W74-00210

### 9D. Grants, Contracts, and Research Act Allotments

**GEORGIA'S WATER PROBLEMS AND RELATED RESEARCH NEEDS,**  
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.  
For primary bibliographic entry see Field 06B.  
W74-00004

## 10. SCIENTIFIC AND TECHNICAL INFORMATION

### 10A. Acquisition And Processing

**DEVELOPMENT AND PILOT-TESTING OF AN AUTOMATIC INFORMATION DISSEMINATION SYSTEM,**  
Environmental Quality Systems, Inc., Rockville, Md.  
For primary bibliographic entry see Field 05D.  
W74-00003

### TRANSFER OF WATER RESOURCES KNOWLEDGE.

Proceedings of the 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado. E. Vlachos, Editor: Water Resources Publications, Fort Collins, 1973. 540 p.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.  
Identifiers: \*Technology transfer, \*Developing countries.

The conference on Transfer of Water Resource Knowledge used a two-fold approach to aspects of transfer: the transfer of knowledge from

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developed to developing countries; and the transfer of knowledge from research to practice. The collection of papers raises major points about the overall process of communicating and transferring knowledge and about the important linking mechanisms between transmitters and receivers. More important, it points out important elements of the process such as the source, methods, channels, receiver, and short- and long-range effects of the communicated knowledge. Transfers of knowledge without any other major socioeconomic changes, without deep transformations in the social structure, and without the commitment of professionals to a wider horizon under the specific cultural conditions of each country and region will be exercises in futility, abortive transplants, and continuous sources of frustration for well meaning technologists. (See W74-00190 thru W74-00228) (Knapp-USGS) W74-00189

#### ECONOMIC ANALYSIS AND MUNICIPAL WATER SUPPLY IN DEVELOPING COUNTRIES,

International Bank for Reconstruction and Development, Washington, D.C.  
J. J. Warford, and P. W. Whitford.  
In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 40-51, 1973. 2 ref.

Descriptors: \*Information exchange, \*Water supply, \*Municipal water, \*Water management (Applied), \*Economics, Social aspects, Cost-benefit analysis, Legal aspects, Research and development, Cost-benefit theory, Technology. Identifiers: \*Technology transfer, \*Developing countries.

Some of the difficulties involved in applying economic theory to the practical problems faced by municipal water supply authorities are discussed with particular reference to conditions in developing countries. Basic economic principles are so crucial and so relevant to this field that there is ample scope to adapt theory to suit the practical circumstances of the water-supply industry, and compromise solutions can be reached that are likely to yield considerable benefits. The problem is to use economics in a way that is palatable to the industry. Pricing and investment policies; principles and problems of implementing marginal cost pricing; the roles of benefit-cost analysis and shadow pricing in project design, selection, and construction; unemployment and acute foreign exchange problems that are typical of developing countries; and the political, institutional, and social barriers to the adoption of economically efficient pricing and investment rules are discussed. (See also W74-00189) (Knapp-USGS) W74-00190

#### RESEARCH IMPLEMENTATION, A COORDINATED APPROACH,

Utah Water Research Lab., Logan.  
J. M. Bagley, J. P. Riley, and D. F. Laurence.  
In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 52-59, 1973. 1 fig.

Descriptors: \*Information exchange, \*Research and development, \*Water resources, Planning, Universities, Research priorities, Technology, \*Coordination.

Identifiers: \*Technology transfer, \*Information exchange.

Ideally, research and practice are linked by two-way information channels which convey research needs, or user problems, to the scientist and research knowledge to the user. Without well developed linkage channels, research programs tend to be fragmented and inconsistent with user needs, while users fail to apply currently available knowledge to meet the problems which they face. Some of the problems associated with the effective two-way flow of information between the research and practice regions and possible techniques for implementing this flow are discussed. Recommendations are given for the improvement of communication. There has apparently been a tendency in the past to treat research, practice, and linkage as independent entities rather than as an integrated system which provides for the effective flow of information within the system as a whole. (See also W74-00189) (Knapp-USGS) W74-00191

#### WATER RESOURCES SCIENTIFIC AND TECHNICAL INFORMATION DISPLAY, STORAGE, AND RETRIEVAL,

Office of Water Resources Research, Washington, D.C. Water Resources Scientific Information Center.

R. A. Jensen.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 60-70, 1973. 5 fig, 4 ref.

Descriptors: \*Abstracts, \*Bibliographies, \*Data processing, \*Information exchange, Documentation, Data collections, Information retrieval, Federal Government, Research and development, Publications, Water resources institute, Water resources Research Act, Digital computers, Computer programs.

Identifiers: \*Technology transfer, \*Water Resources Scientific Information Center, Office of Water Resources Research.

Information storage and retrieval activities currently being conducted by the Water Resources Scientific Information Center of the Office of Water Resources Research in the U.S. Department of the Interior are described. University water resources research groups are used as input centers to convert information collected in performing their own research to a common format which, when merged, forms a comprehensive and searchable information base. The general information processing system (GIPSY) is used by the prototype network, with terminals at the University of Wisconsin, Cornell University, and The University of North Carolina. GIPSY is a search program plus a set of utility programs which operate in batch or tele-processing mode from remote terminals. GIPSY operates in the online reactive mode, and can be used for generating topical bibliographies. (See also W74-00189) (Knapp-USGS) W74-00192

#### THE INFORMATION SCIENCE APPROACH TO TRANSFER OF KNOWLEDGE,

Bureau of Reclamation, Denver, Colo. Engineering Reference Branch.

W. B. Mc Birney.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 71-79, 1973.

Descriptors: \*Abstracts, \*Bibliographies, \*Data processing, \*Information exchange, Documentation, Data collections, Information retrieval, Federal Government, Research and development,

Publications, Digital computers, Computer programs.

Identifiers: \*Technology transfer, \*Bureau of Reclamation, \*Information science.

The information science approach to facilitating the transfer of knowledge is discussed in general terms. Use of abstract bulletins, selective dissemination of information, bibliographies, state-of-the-art reviews, microforms, and retrieval are reviewed. The operational scientific information program of the Bureau of Reclamation is described in its application of the computer for dissemination and retrieval. A brief view is given of feasible methods for providing scientific information to developing countries as compared to more modern societies. (See also W74-00189) (Knapp-USGS) W74-00193

#### TRANSMITTING WATER RESOURCES INFORMATION BY A TIME-SHARE SYSTEM,

New Mexico State Univ., University Park.

C. G. Keyes, Jr., and R. T. Telfer.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 80-88, 1973. 5 fig, 5 ref. Bur. of Reclam. 14-06-D-6803.

Descriptors: \*Abstracts, \*Bibliographies, \*Data processing, \*Information exchange, Documentation, Data collections, Information retrieval, Federal government, Research and development, Publications, Digital computers, Computer programs.

Identifiers: \*Technology transfer, Time-share computers.

A time-share computer system may be used to transmit water resources information. The basic system consists of a central processing unit, terminal locations, input data locations, and output data locations or users. The system could be expanded to include real-time forecasting or design in any atmospheric water resources program. (See also W74-00189) (Knapp-USGS) W74-00194

#### DEVELOPING A COOPERATIVE RESEARCH PROGRAM FOR FLOOD CONTROL IN BRAHMAPUTRA VALLEY,

Brahmaputra Flood Control Commission (India).

S. N. Gupta.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 98-109, 1973. 3 fig.

Descriptors: \*Information exchange, \*Flood control, Floods, Model studies, Braiding, Mathematical models, Sediment transport.

Identifiers: \*Technology transfer, \*Assam.

The Brahmaputra River in the northeastern region of India causes flood and erosion problems. The Government of Assam created a Flood Control Commission in July 1970 to study flood problems of the valley and prepare a master plan for flood control. A comprehensive cooperative research program is being planned by Hydrology Directorate of Central Water and Power Commission, India, and Hydrology and Water Resources Wing of Colorado State University, Fort Collins, to study the problems. The availability of high speed computers of large capacity makes it possible to simulate the performance of relatively complex river basin systems for periods of any desired length. Design, construction, and operation of a mathematical model for Brahmaputra basin will provide a tool for the study of complex flood phenomena in the valley. It will also depict how

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river training measures should be devised to least interfere with the channel regime and, at the same time, control bank erosion. Study of hydrology of Brahmaputra River is a suitable subject for cooperative research. (See also W74-00189) (Knapp-USGS)  
W74-00195

#### APPLICATION OF HYDROGEOLOGICAL DATA TO LONG-TERM ECONOMICS OF GROWING SUGAR CANE IN VENEZUELA, Water Development Corp., Tucson, Ariz.

L. C. Halpenny, and A. Dupuy.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 110-115, 1973. 1 fig.

Descriptors: \*Information exchange, \*Irrigation practices, \*Withdrawal, \*Conjunctive use, Sugarcane, Economics, Water yield.

Identifiers: \*Technology transfer, \*Venezuela.

Transfer of hydrogeological knowledge from research to practice and from developed to developing regions has been successfully achieved beginning in 1959 under a cooperative effort between consulting hydrologists and sugar cane growers in Venezuela. The program was begun by Central El Palmar within the area drained by Rio Aragua in the State of Aragua, Venezuela. The area is intensively farmed with irrigated agriculture, of which a substantial portion is sugar cane. The water supply for irrigation is obtained partly from stored surface-water runoff and partly by pumping wells. The initial objective of the program was to detect changes in groundwater levels from which predictions could be developed as to whether or not the groundwater system was being overdeveloped. This early warning system indicated in 1962 that Tocoron subarea in Aragua State was being overdeveloped, and arrangements were made to reduce pumping and to divert more surface water to the area. Evaluation of water-supply data made it possible to refine the consumptive use calculations for planning future irrigations. Optimum cane yield results when 200 cubic meters of total water supply is available for each metric ton of cane produced. (See also W74-00189) (Knapp-USGS)  
W74-00196

#### PUERTO RICO: A CASE STUDY OF WATER RESOURCE TECHNOLOGY TRANSFER, Puerto Rico Dept. of Public Works, San Juan, Area of Natural Resources.

W. E. Nothdurft.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 116-124, 1973. 3 ref.

Descriptors: \*Information exchange, \*Water resources development, \*Puerto Rico, Water management (Applied), Planning, Urbanization, Government, Social aspects, Political aspects, Flood protection, Dams, Reservoirs.

Identifiers: \*Technology transfer.

The transfer of water resources knowledge from developed to developing areas involves transfers from point to point within a given system or institutional management structure, and transfers from some external source into a given system or institutional management structure. The theoretical framework of these transfers and the barriers to their efficient functioning in the water resource management institutional structure of one developing area, the Commonwealth of Puerto Rico, is discussed. Barriers, or inefficiencies, in intrasystem transfers are closely related to the

level of managerial sophistication in the institutional structure. On the other hand, inefficiencies in intersystem transfers can generally be attributed to institutional inflexibility on the part of either the transfer recipient (as is generally the case), the transfer source, or both; and the incapacity of the recipient system to absorb new inputs. (See also W74-00189) (Knapp-USGS)  
W74-00197

#### TRANSFER OF KNOWLEDGE IN WATER RESOURCES FROM RESEARCH TO PRACTICE,

European Economic Commission, Geneva (Switzerland). Environment Div.

A. D. Pobedimsky.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 125-131, 1973.

Descriptors: \*Information exchange, \*Europe, \*United Nations, Conferences, Education, Water management (Applied), Research and development.

Identifiers: \*Technology transfer.

The purpose is to describe how an international organization (the UN Economic Commission for Europe) transfers knowledge in the field of water resources from research to practice. Emphasis is placed on the pooling of international experience in the field of water resources development and water quality problems, on studies and seminars in this field, and on the transferring of national experience through systematic circulation of technical information. Suggestions are also offered as to the efficient transfer of knowledge by international organizations and the eventual use in national practices. (See also W74-00189) (Knapp-USGS)  
W74-00198

#### THE ROLE OF THE INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE IN THE TRANSFER OF WATER RESOURCES KNOWLEDGE,

Bureau of Reclamation, Denver, Colo. Technical Services Branch.

L. D. Stephens.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 132-142, 1973.

Descriptors: \*Information exchange, \*Irrigation, \*Drainage, Water management (Applied), International Commissions.

Identifiers: \*Technology transfer, \*International Commission on Irrigation and Drainage.

The International Commission on Irrigation and Drainage provides a forum for the development of the sciences and techniques of irrigation engineering, flood control, and river training. The role of the Commission in transferring water resources knowledge in these areas from research to practice and from developed to developing countries is discussed. Activities of the Commission are described, and currently available publications are summarized. (See also W74-00189) (Knapp-USGS)  
W74-00199

#### HOW ENGINEERING RESEARCH IS REDUCED TO PRACTICE IN THE BUREAU OF RECLAMATION,

Bureau of Reclamation, Denver, Colo. Engineering and Research Center.

H. J. Cohan, and W. P. Simmons.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 148-154, 1973.

Descriptors: \*Research and development, \*Information exchange, \*Water resources development, Hydrology, Dams, Irrigation, Reservoirs.

Identifiers: \*Bureau of Reclamation, \*Technology transfer.

The Bureau of Reclamation and its activities, how research needs are identified, and how planning and engineering research is organized and carried out to satisfy those needs are described. How research results are transferred into practice is shown by case histories. The continuing search for improvements in ways of transferring research results into practice, and the present status of techniques being utilized are described. The importance of 2-way communication and feedback is stressed. (See also W74-00189) (Knapp-USGS)  
W74-00200

#### RESEARCH FINDINGS AND THE DESIGN ENGINEER,

Auburn Univ., Ala.

C. H. Harrison.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 155-161, 1973. 5 ref.

Descriptors: \*Information exchange, \*Bibliographies, \*Publications, \*Engineering, Water resources development.

Identifiers: \*Technology transfer.

An engineer with a design problem will attempt to locate information either by consulting a colleague or by reference to an index. The Cumulative Index to ASCE Publications is suggested as a good starting point. More recent research findings can often be obtained by phoning or writing the author of an article appearing in an ASCE journal or by contacting a researcher listed in the Water Resources Research Catalog. Where the Citation Index is available, more recent publications on a given subject can be quickly located by using ASCE publications as a starting point. Abstracts alone are of little value to a design engineer. The design engineer's need for immediate reference material places a large responsibility on the reviewers of the major technical journals. These reviewers should also pay attention to the quality of the reference supplied with a technical paper because of the increasing use of the Citation Index. (See also W74-00189) (Knapp-USGS)  
W74-00201

#### TECHNICAL AID FOR HYDROLOGIC STUDIES IN SPANISH-SPEAKING COUNTRIES,

Geological Survey, Lakeland, Colo.

O. J. Taylor.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p. 162-166, 1973.

Descriptors: \*Information exchange, \*Foreign projects, Hydrology, Computer programs, Mathematical models, Hydrogeology.

Identifiers: \*Technology transfer, \*Chile, \*Canary Islands.

Recent technical aid for hydrologic studies in Chile, the Canary Islands, and Spain emphasized the necessity for communication in various specialties. The projects included design and in-

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terpretation of digital-computer simulation models for a stream-aquifer system in central Chile and preparation of computer programs for the processing of chemical data from the Canary Islands. The results of studies published by the various countries showed that the technical assistance was effective. The success of the technical aid was strongly dependent on communication with Spanish-speaking hydrologists in mathematics, computer science, hydrology, and related technologies. Failure to communicate in technical specialties may easily lead to misunderstanding of problems, misleading results, or completely erroneous results. (See also W74-00189) (Knapp-USGS) W74-00202

#### THE ROLE OF PROFESSIONAL SOCIETIES IN THE DISSEMINATION OF WATER RESOURCES RESEARCH INFORMATION, American Society of Civil Engineers, New York. Research services.

D. C. Taylor.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 167-185, 1973. 12 ref, 2 append.

Descriptors: \*Information exchange, \*Professional societies, \*Technical societies, Publications, Conferences, Documentation, Abstracts, Information retrieval, Data collections.

Identifiers: \*Technology transfer.

Professional societies, because of the nature of their membership, have a major role to play in the interpretation and dissemination of research information to their members for practical use. In few other ways are the members of the profession brought together so closely on technical and professional issues. Traditional methods of disseminating information by professional societies are still very effective and include conference symposia, technical magazines and journals, and meetings. There are also trends toward providing easier ways for busy professionals to locate and put to use relevant information such as the use of information storage and retrieval systems and publication of state of the art studies. Research-in-progress surveys and research needs studies help link research as well as make it relevant to practice. New and expanding continuing education services bring new information to members faster. (See also W74-00189) (Knapp-USGS) W74-00203

#### THE WATER RESOURCES INFORMATION PROGRAM AT THE UNIVERSITY OF WISCONSIN, Wisconsin Univ., Madison. Water Resources Center.

L. G. Zweifel, J. R. Luedtke, and J. E. Kerrigan. In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 186-198, 1973.

Descriptors: \*Wisconsin, \*Abstracts, \*Bibliographies, \*Data processing, \*Information exchange, Documentation, Data collections, Information retrieval, Federal Government, Research and development, Publications, Water resources institute, Water Resources Research Act, Digital computers, Computer programs.

Identifiers: \*Technology transfer, \*Water Resources Scientific Information Center.

The rapid growth of scientific information coupled with an increasing need to correlate diverse kinds of information in specialized research led to the development of information exchange and

technology transfer systems. The establishment of the Water Resources Information Program at the University of Wisconsin was facilitated by the prior existence of several smaller information programs. These individual elements were consolidated to respond effectively to the needs of the information transfer activity. The information role of the Water Resources Center was expanded in 1968 when it was designated a center of competence in the field of eutrophication by the Water Resources Scientific Information Center of the Office of Water Resources Research. The Center identifies significant literature and submits abstracts for the OWRR's semimonthly publication, Selected Water Resources Abstracts. The grant enables the information program to broaden its literature search capabilities, increase the number of abstracts, publish specific reviews of the literature, and distribute copies of abstracts to scientists and librarians throughout the world. A computer network provides terminal services to the water resources community in a 21-state western region for literature searches for technical and research projects. (See also W74-00189) (Knapp-USGS) W74-00204

#### EUTROPHICATION RESEARCH APPLIED TO WATER QUALITY MANAGEMENT ON THE GREAT LAKES,

Department of the Environment, Burlington (Ontario). Centre for Inland Waters.

A. R. LeFeuvre, and J. P. Bruce.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 199-210, 1973. 1 fig, 11 ref.

Descriptors: \*Information exchange, \*Eutrophication, \*Great Lakes, Canada, International Joint Commission, Lake Erie, Lake Ontario, Data collections, Water quality control, Water management (Applied).

Identifiers: \*Technology transfer.

The eutrophication control program and negotiation of the Great Lakes Water Quality Agreement are excellent examples of a situation in which research results were quickly and effectively used in development of public policies and had a profound impact on these policies. The ingredients of this successful and rapid transfer of research findings to action programs are (1) an effective mechanism to mobilize both scientific and management manpower, (2) a procedure for public and media involvement in formulation of recommendations, (3) governmental organizations that have research activities built into the management responsibility structure, and (4) a deliberate commitment of highly qualified manpower to help the transfer and conversion process. (See also W74-00189) (Knapp-USGS) W74-00205

#### WATER RESOURCES DEVELOPMENT POLICIES AND TRANSFER OF KNOWLEDGE FROM DEVELOPED TO DEVELOPING COUNTRIES,

Tahal Consulting Engineering Ltd., Tel Aviv (Israel).

A. Wiener.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 237-245, 1973.

Descriptors: \*Information exchange, \*Foreign projects, \*Water resources development, \*Water management (Applied), International commissions, Irrigation.

Identifiers: \*Technology transfer, \*Developing countries.

A meaningful study of the transfer from developed to developing countries of information, know-how, and technology relating to water resources has to consider not merely water as an isolated resource, but the whole complementary complex that is relevant to its use. Water is either an infrastructural feature, as it is in community and many industrial water supplies, or a production input, as it is in irrigation or in the wet industries. In both modes of water use the transfer of information ought not be confined to the resources aspects alone, but should also include economic, social, institutional, and political aspects. For projects to be effective in developing countries, they would have to include not only the physical infrastructural features from projects in developed countries, but also the elements connected with overcoming the inadequacy of underdevelopment, such as the lack of capacity to spontaneously produce the necessary transformation relating to rural organization, motivation, and information transfer down to the production level. (See also W74-00189) (Knapp-USGS) W74-00206

#### WATER RESOURCES UTILIZATION IN DEVELOPING COUNTRIES,

Universidad Central de Venezuela, Caracas.

L. E. Franceschi.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 246-251, 1973.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries.

Basically, a water plan for a developing country should provide the necessary foresight to the decision making process, so that decisions are made with an awareness of their consequences, under priority preferences for solving the multiple, interrelated problems to be encountered. This calls for identifying the problem areas associated with water; assessing water problems, water availability and related land use conflicts; and preparing a plan that considers several planning stages differing in detail and precision but within the same orientation scope. Planning the use of a scarce resource is a permanent and continuous process in which the master plan encompassing the other stages is the most important instrument for any developing country. To assess water associated problems and formulate the plan, the most important tool is the water balance which is used to make logical allocation of the available water among potential users of a hydrographic unit in which several basins may be grouped. (See also W74-00189) (Knapp-USGS) W74-00207

#### OBSTACLES TO CONSIDERATION OF RESOURCES MANAGEMENT ALTERNATIVES: SOUTH ASIAN EXPERIENCE,

D. U. Hewapathirane, and G. F. White.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 252-261, 1973. 35 ref.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries, \*Sri Lanka (Ceylon).

## Field 10—SCIENTIFIC AND TECHNICAL INFORMATION

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One of the principal reasons for ineffective water management measures in developing countries is the failure of planning agencies (both consulting firms and government offices) to give consideration to alternatives to conventional techniques. As a result, some works fail to meet their social goals or have the opposite effects, and the less conventional techniques are neglected. Experience with river management programs in Sri Lanka (Ceylon) and the Lower Mekong Basin illustrate these points. Failure stems in large part from the method of training professional personnel and from the rigid definition of administrative missions for government agencies. Neither of these conditions is susceptible to early or easy correction. However, it is likely that partial remedy could be obtained rather readily at low cost by a combination of two activities: (1) adoption of a criterion that examination of alternatives should be an integral part of review of project proposals by multilateral and bilateral financial agencies, and (2) short-term training for principal technical personnel. (See also W74-00189) (Knapp-USGS)  
W74-00208

#### TRANSFER OF WATER RESOURCES KNOWLEDGE FROM DEVELOPED TO DEVELOPING REGIONS OF THE WORLD,

Engineering Science, Inc., Berkeley, Calif., and

Engineering Science, Inc., McLean, Va. International Div.

F. L. Hotes.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 262-269, 1973.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries.

In working in developing countries, primarily in water resources and agricultural development, knowledge of specialized mechanical skills, as well as that of the physical and social sciences, must be transferred. The transfer process is not complete until the developing nation has an active, permanent reservoir of water resources knowledge. Examples are given of problems stemming from the attitudes and traditions of both expatriate experts and developing country nationals. Oversophisticated methods inapplicable in most developing countries should not be taught intensively. If methods are conceived with the aid of people in such countries and executed in the developing world as frequently as possible, they should produce better results. (See also W74-00189) (Knapp-USGS)  
W74-00209

#### KNOWLEDGE TRANSFER,

Utah State Univ., Logan. International Programs and Studies.

B. H. Anderson.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 270-279, 1973.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries.

United States universities and colleges will be involved in the education of foreign students for some time. The mechanisms or techniques of knowledge transfer and the kinds of problems that impede the process are discussed. For universities wanting to accommodate the real needs of foreign students, ideas and innovations in training are discussed. Emphasis is given to special short courses which can provide excellent opportunities for practical training programs. Properly planned courses can provide excellent knowledge transfer opportunities. However, this raises the question of the excellent knowledge transfer opportunities. However, this raises the question of the role to be played by various agencies and suggests that a new mechanism be found allowing a more direct approach between institutions involved in knowledge transfer. (See also W74-00189) (Knapp-USGS)  
W74-00210

#### A CASE ON TRANSFER OF KNOWLEDGE IN WATER RESOURCES SYSTEMS PLANNING FROM A DEVELOPED REGION TO A DEVELOPING ONE, AND FROM RESEARCH TO APPLICATION,

Chile Univ., Santiago. Faculty of Physical and Mathematical Sciences.

J. A. Poblete, and R. Harboe.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 280-293, 1973. 36 ref.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries.

A brief description of a process of transfer of knowledge from one region to another and from research to application in the area of Water Resources Systems Planning is given. This description is based on the experience gained by the Centro de Planeamiento (CEPLA), a center of applied research and teaching in planning and economics at the School of Engineering of the University of Chile (UCH), over a period of approximately 10 years. Two interuniversity programs, one between the Department of Civil Engineering of the Massachusetts Institute of Technology (MIT) and CEPLA, and the other from the Water Resources Planning Group at the University of California, Los Angeles, (UCLA) and CEPLA, are described. A prolonged professional working seminar and two applied research projects are discussed. These activities have been designed by CEPLA as a means of transfer of knowledge from research to application. A working seminar for professionals, extended over a prolonged period of time and organized at a university, is successful and is a neutral ground for discussion among specialists of the conflicting aspects which characterize the water resources problems. It also provides an opportunity to present to professionals some of the relevant applied research projects that are being developed at universities and foreign countries. Applied research projects and the training of professionals and students who participate as technical staff in those projects is a promising vehicle of transfer from research to application. (See also W74-00189) (Knapp-USGS)

W74-00211

#### RESEARCH AND EDUCATION FOR DEVELOPMENT,

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

M. L. Albertson, and M. T. Chaudhry.

In: Transfer of Water Resources Knowledge, Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 294-306, 1973. 3 fig, 18 ref.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries.

Progress in developing countries requires plans, programs, manpower, and institutional resources. Manpower and resources are the result of education, training, and experience, while the basic informational resources for plans and programs come from research and study. Literature on development should be expanded and made available to the people. Participation of people from the less developed countries should be increased. This means more students and participants in seminars and discussion groups. Documentary films of lectures of the outstanding professors on various topics related to development should be prepared and made available to students and working people. Stronger and more extensive links should be established between universities and development agencies. Programs of research should be initiated to study the sociology of the educated, to determine their value, attitudes, and difficulties as they reflect on the development process. A research program should be started, and education should be spread on establishing democratic developmental institutions, which should replace existing authoritative structures. (See also W74-00189) (Knapp-USGS)  
W74-00212

#### VENEZUELAN EXPERIENCE ON THE TRANSFER OF KNOWLEDGE IN WATER RESOURCES ENGINEERING,

Universidad Central de Venezuela, Caracas.

J. N. Acutino, and J. I. Sanabria.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 321-327, 1973. 1 fig, 1 tab.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspect, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries, \*Venezuela.

The mechanics of transfer knowledge and the path followed in Venezuela were studied in order to bring out the difficulties of the actual system and search for recommendations which permit the increase of efficiency of such transfer. Subjects surveyed were engineers in some of the fields of hydraulic resources engineering. Experience from developed areas is the main source of information of engineers involved in project activities. Local experiences are mainly used by engineers working on planning of water resources. Information is generally obtained by means of books and journals of professional societies. The lowest-percentage path followed by the knowledge corresponds to a personal contact with members of research institutions and universities. Engineers involved in planning activities reported the nonapplication of some techniques because of the quality and range of data required. There is a trend among publications from developed areas to be more scientific than practical. Thus publications are becoming a limited source of information for developing areas due to the character of their specialized problems. A typical example is research in the fields of

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scour; many laboratory studies have been realized, but few field measurements are reported. Periodical meetings, seminars, and short courses are good means of making personal contacts and effecting interchange of knowledge. (See also W74-00189) (Knapp-USGS)  
W74-00213

#### ACHIEVEMENTS OF INDIA IN THE FIELD OF WATER RESOURCES DEVELOPMENT, Central Water and Power Commission, New Delhi (India).

S. K. Jain.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 328-335, 1973, 1 tab.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries, \*India.

In assessing water resources and the efforts for planning in India, emphasis is placed not only on structures and design, but also on the management and operation of various projects. Knowledge gained through such organizations as the Water and Power Development Consultancy Services as well as a multitude of other state agencies can be made available to other developing nations and, thus, contribute to the needed continuous transfer of experience. (See also W74-00189) (Knapp-USGS)  
W74-00214

#### EXPERIENCE OF THE U.S. GEOLOGICAL SURVEY IN TRANSFER OF HYDROLOGIC KNOWLEDGE TO THE DEVELOPING COUNTRIES,

Geological Survey, Washington, D.C. Office of International Activities.

G. C. Taylor, Jr.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 334-344, 1973, 4 tab.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries, \*U.S. Geological Survey.

The U.S. Geological (USGS) has participated in overseas technical assistance programs for more than 30 years. Between 1940 and 1970 USGS water scientists and engineers completed 347 project oriented assignments in 80 host countries. During the same period 426 water scientists, engineers, and technicians from 61 countries received academic and inservice training through USGS facilities in the United States. Training is a basic ingredient of the institution building process. Technical competence, adaptability to host country constraints, and personal sympathy with host country needs and aims are important qualities in the USGS specialist on foreign assignment. Most important to successful technical assistance is the provision of qualified local individuals for training as well as leadership and administrative support. Continuity of relationship between the USGS and its host country counterpart has been found to be the single most important factor contributing to the growth of a viable water-resources organization over a period of years. (See also W74-00189) (Knapp-USGS)

W74-00215

#### SOME PROBLEMS ASSOCIATED WITH THE USE OF FOREIGN ADVISORS IN DEVELOPING COUNTRIES, Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.

W. W. Shaner.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 345-355, 1973.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries.

Many developing countries in the early stages of economic development and planning have to rely on foreign organizations and advisors. This reliance is likely to continue until sufficient time has lapsed to permit the country to develop its institutions and train its own specialists and administrators. However, making good use of foreign technology involves a number of problems, many of which are only discovered through living and working in such countries. These problems involve the promoters, the biased, the impossible, the irrelevant, the confusion, the out of place, the sophisticates, the vacationers, and the old timers. Better knowledge of these problems followed by appropriate action should lead to an easier and more efficient transfer of technology between the developed and the developing countries. (See also W74-00189) (Knapp-USGS)  
W74-00216

#### TRANSFER OF KNOWLEDGE IN WATER RESOURCES FROM DEVELOPED TO DEVELOPING REGIONS WITH SPECIAL REFERENCE TO THE CONDITIONS OF WEST PAKISTAN, Ministry of Finance, Planning and Development, Islamabad (Pakistan). Div. of Water Resources.

S. K. Malik.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 356-365, 1973, 1 fig, 2 tab.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries, \*West Pakistan.

The main problems of water resources development in West Pakistan, especially the major works undertaken in the Indus River Basin, are discussed. In the context of these works the role of foreign advisers, consultants, and contractors from developed countries is discussed, and the successes and failures of such a cooperation are juxtaposed. From past experience proposals for the future include the acquainting of foreign experts with local circumstances, raising of the level of technical expertise, and a broader understanding of the socioeconomic milieu within which development takes place. (See also W74-00189) (Knapp-USGS)  
W74-00217

#### DEVELOPMENT OF MATHEMATICAL MODELING CAPABILITIES FOR THE VISTULA RIVER PROJECT, POLAND, Water Resources Engineers, Inc., Walnut Creek, Calif.

G. T. Orob, I. P. King, and D. F. Kibler.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 384-392, 1973, 1 fig, 2 ref.

Descriptors: \*Information exchange, \*Mathematical models, \*Systems analysis, \*Water resources development, Water supply, Optimization, Education, Training.

Identifiers: \*Technology transfer, \*Poland.

Under sponsorship of the United Nations Development Program, Poland performed a study of alternative plans for the optimal utilization of the Vistula River System, the country's primary water resource. An important element of the study involved training of Polish engineers in mathematical modeling techniques already in use in the United States and the transfer of this knowledge through a working team to facilitate development and application of models in Poland. A high degree of rapport and mutual respect for technical competence of model team participants was developed. Substantial advances in the mathematical modeling art were made, especially in the development and refinement of the One-Step Water Resources Allocation Model, VISSIM. Other notable contributions were in the development of a versatile power optimization program by the Polish team and the initial application of a stream temperature model to the Vistula River System. As an exercise in the interchange of water resources planning knowledge, the experience was rewarding to all. (See also W74-00189) (Knapp-USGS)  
W74-00218

#### METHODS OF TRANSFER OF WATER RESOURCES KNOWLEDGE FROM DEVELOPED TO DEVELOPING REGIONS WITH SPECIAL EMPHASIS TO ON-FARM WATER MANAGEMENT, Agency for International Development, Washington, D.C. Office of Agriculture and Fisheries.

O. J. Kelley.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 393-406, 1973, 1 ref.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, \*Farms, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data, Irrigation water, Groundwater, Soil water.

Identifiers: \*Technology transfer, \*Developing countries.

There is no single direct transfer of knowledge and technology from the developed to the developing country. In farm water management, the ultimate target of any knowledge transfer is the individual farmer, for it is on the farm land where the production resources are all integrated into an agricultural production system. In order to reach the farmer it is often necessary to train farm advisors, system operators, and administrators, and to develop production processes and institutions. Markets provide a direct contact with the farmer and are of great importance as a mechanism for knowledge transfer. Modern on-farm water management technology in developed countries is highly capital-intensive, highly energy intensive, and has a low labor requirement. In developing countries such as India and Pakistan, the energy simply is

## Field 10—SCIENTIFIC AND TECHNICAL INFORMATION

### Group 10A—Acquisition And Processing

not available; likewise capital is very scarce and labor is abundant. Modern systems which are fully automatic would, therefore, have only limited application in such countries. A particular advantage of modern water technology is the advantage of the built-in decisions that a well designed system has for correct water application. A well designed modern system has a considerable amount of management built into it, and the farmer is automatically led to the correct decision in the application of water to his land. (See also W74-00189) (Knapp-USGS)  
W74-00219

#### GUIDELINES FOR TRANSFER OF PRACTICE TO APPLICATIONS FOR OPTIMUM ON PLANNING OF KEY ITEMS OF WATER RESOURCE PROJECTS,

Madhya Pradesh Government Control Board for Major Projects, Bhopal (India).

D. R. Sikka.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 407-413, 1973.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries.

In water projects in developing countries, the greatest bottleneck is the absence of an overall body for investigating, planning, construction, and management. Free flow and exchange of useful scientific data between private and public organizations rather than compartmentalization is also essential. It is desirable to prescribe suitable norms and criteria for a program of transfer of knowledge on Water Resources Projects. There is urgent need for international standardization of data from the practical and construction point of view. The classification, if done by collecting data on all the sizable dams constructed all over the world, would allow useful knowledge derived from practical results to be diverted for use elsewhere. (See also W74-00189) (Knapp-USGS)  
W74-00220

#### NEW FRONTIERS IN DRAINAGE AND RECLAMATION ENGINEERING IN THE INDUS PLAINS,

S. K. Mohiuddin Khan.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 414-422, 1973. 5 ref.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries, \*West Pakistan.

Drainage and reclamation in West Pakistan involve transfer of knowledge not only from developed countries to developing countries but also from research and local experience to practical implementation in the last two to three decades. Greater success in transfer of knowledge would have been facilitated by adopting intimate association with local experts who know the area and problems, and proper check on consultants of foreign aided projects; restriction on large scale transfer of sophisticated techniques of developed countries to developing countries without

thorough analysis of all technical and socioeconomic aspects; seminars and symposia at different stages of investigation planning, project preparation, operation and maintenance; and more thorough post project monitoring and evaluation. (See also W74-00189) (Knapp-USGS)  
W74-00221

#### AN IHD PROJECT FOR TECHNOLOGY TRANSFER TO DEVELOPING REGIONS,

Hydrologic Engineering Center, Davis, Calif.  
E. F. Hawkins.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 438-448, 1973. 2 tab, 5 ref.

Descriptors: \*Water resources development, \*Information transfer, \*Training, Management, Statistical methods, Mathematical studies, Mathematical models, Hydrology, Conferences, \*International Hydrologic Decade.

Identifiers: \*Technology transfer, \*U.S. Army Corps of Engineers.

As part of the United States program for the International Hydrologic Decade (IHD), the U.S. Army Corps of Engineers developed a project entitled Hydrologic Engineering Methods for Water Resources Development. The objectives of the project are to develop and test methods suitable for practical applications of hydrologic engineering and to document these methods in a report. Special attention is given to circumstances under which there are deficiencies in the length, accuracy, and general coverage of hydrologic records. A workshop was given to provide engineers engaged in day-to-day planning, design, and operation of water resources projects with a thorough understanding of the application of a comprehensive variety of hydrologic engineering techniques. The workshop is divided into four major areas: (1) fundamental considerations in water resources development; (2) statistical and mathematical techniques for hydrologic engineers; (3) analysis of natural hydrologic systems; and (4) analysis of water resources development. (See also W74-00189) (Knapp-USGS)  
W74-00222

#### THE ROLE OF FAO IN THE TRANSFER OF WATER RESOURCES KNOWLEDGE TO DEVELOPING REGIONS,

Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.

H. W. Underhill, R. G. Thomas, and D. Salomons.  
In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 449-461, 1973. append.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries, \*Food and Agricultural Organization (UN).

The transfer of knowledge is not an end in itself; the end is to benefit mankind. This benefit will only be achieved if the knowledge is suitable, is adequately transmitted to a well motivated recipient, and is correctly applied. Every situation demands a different solution. FAO has wide experience in this sphere. The transfer of knowledge of the right kind and at the right level to be immediately absorbed and applied is the key to development. The choice and preparation of the

individuals—those who are to transmit, and those who are to receive and apply the knowledge—are crucial. (See also W74-00189) (Knapp-USGS)  
W74-00223

#### TECHNICAL ACTIVITIES BY FAO IN THE TRANSFER OF WATER RESOURCES KNOWLEDGE TO DEVELOPING REGIONS,

Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.

C. E. Houston, and H. M. Horning.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 462-472, 1973. 1 fig, 7 ref.

Descriptors: \*Information exchange, Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries, \*Food and Agricultural Organization (UN).

Water must be studied, developed, and used as a single resource. Technical manpower for study and development of water resources in many developing countries is of a high caliber, but as with many developed countries the utilization of the end project is the gap leading to success or failure. FAO is attempting to fill that gap through field projects, seminars, and publications. The first step in this process is to create an awareness with Governments, then with Technical Services, and finally with the water users. The success or failure of the end user determines the success or failure of an irrigation project, not the engineering design and construction. (See also W74-00189) (Knapp-USGS)  
W74-00224

#### TRANSFER OF KNOWLEDGE IN WATER RESOURCES POLICIES FROM DEVELOPED TO DEVELOPING COUNTRIES,

United Nations Water Resources Development Center, New York.

K. Szeszay.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 473-479, 1973. 9 ref, append.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, \*Water policy, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries, \*United Nations.

There are well developed forms and channels for transferring scientific and technological knowledge in the field of water management. Fields and types of knowledge in which transfer and assistance may be needed depend largely on projected demands and strategies for water resources development and management. Policy formulation is itself, therefore, an important field for consideration by the conference. Possibilities and limitations for transferring knowledge in this sector are discussed in the light of recent United Nations experiences and programs. The selection of the proper level of technology corresponding to future investment capabilities and manpower resources is particularly emphasized. (See also W74-00189) (Knapp-USGS)  
W74-00225

## SCIENTIFIC AND TECHNICAL INFORMATION—Field 10

### Preparation of Reviews—Group 10F

#### TRANSFER OF WATER RESOURCES KNOWLEDGE THROUGH THE UNITED NATIONS TECHNICAL ASSISTANCE ACTIVITIES,

United Nations Water Resources Development Center, New York.

R. E. Dijon.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 480-493, 1973. 1 append.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, Developing countries, \*United Nations.

The United Nations provides technical assistance in the field of water resources to many developing countries, especially as an Executing Agency of the United Nations Development Program. Training is provided on an on-the-job basis, as well as through fellowships abroad. Local national conditions have to be considered; what is relevant for temperate regions does not necessarily apply to tropical areas. First priority is to be given to projects which can lead, within a short period of time, to practical results. The human factor is essential; training programs should be adapted to the academic and professional background of the local personnel. More should be done for the dissemination and exchange of information, not only from developed regions to developing regions, but also on a broad regional and international basis. (See also W74-00189) (Knapp-USGS)

W74-00226

#### RECENT DEVELOPMENT OF HYDROLOGICAL SERVICES IN COLOMBIA,

World Meteorological Organization, Bogota (Colombia).

W. Klohn, and S. Stanescu.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 494-504, 1973. 4 fig, 16 ref.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries, \*Colombia.

Hydrological investigation was limited in Colombia until 1968 when a national hydrological and meteorological service was started as a joint project of the Colombian Government, the World Meteorological Organization, and the United Nations Development Program. Technical assistance in hydrology offered by an international team of experts was directed mainly towards hydrometeorological network design and construction of the stations, personnel training on hydrological techniques, and introduction of procedures for data collection, processing, analyzing and interpretation. This is a typical case of transfer of knowledge from developed regions to a developing country. However, knowledge was not transferred uncritically but screened for applicability under the specific local conditions. The use of digital recorders was rejected. For the Colombian network, long-range strip-chart recorders were selected as the most suitable type. The relationship between the hydrological regime and the physical characteristics of the basins was useful. Because Colombian land use is changing rapidly from forest to cattle raising and agriculture, the

hydrological regime of most rivers is changing towards more extreme flood peaks and low waters. Therefore, theoretical frequency is not applicable indiscriminately, and graphical empirical methods offer definite advantages. (See also W74-00189) (Knapp-USGS)

W74-00227

#### TRANSFER OF WATER RESOURCES KNOWLEDGE ASPECTS OF THE WORK OF THE UNITED NATIONS SYSTEM,

United Nations Educational, Scientific and Cultural Organization, Paris (France). Office of Hydrology.

F. H. Verhoog.

In: Transfer of Water Resources Knowledge; Proceedings of 1st International Conference on Transfer of Water Resources Knowledge, September 1972, Fort Collins, Colorado: Water Resources Publications, Fort Collins, p 505-514, 1973. 4 ref.

Descriptors: \*Information exchange, \*Planning, \*Water resources development, Water management (Applied), Irrigation, Economics, Social aspects, Political aspects, Data collections, Hydrologic data.

Identifiers: \*Technology transfer, \*Developing countries, \*United Nations.

The work of the United Nations system in the transfer of water resources knowledge is described with emphasis on Unesco's role. The Agencies of the United Nations System put considerable effort into the transfer of knowledge from the developed to the developing countries. The volume, expressed in dollars, spent by United Nations on water resources knowledge transfer is only a fraction of the total world volume; therefore, United Nations effort is especially directed towards incentive action and assistance in planning. A country can promote the inflow of knowledge by one or a combination of the following: purchase of complete solutions, procedures, equipment, and manpower without any national scientific effort; recruitment of foreign specialists to teach and train nationals; sending nationals abroad to obtain the required knowledge; and procurement of published information from one or more developed countries. In addition to the training component inherent in every project, there is the idea that national and foreign experts work closely together. This seems to be the best way to transfer technology because all factors needed for success are available. After training abroad the national engineers are, if necessary, given an interesting job in their own country together with a foreign expert from whom they can learn everything necessary. (See also W74-00189) (Knapp-USGS)

W74-00228

## 10F. Preparation of Reviews

#### MERCURY: ENVIRONMENTAL CONSIDERATIONS, PART I,

Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.

For primary bibliographic entry see Field 05C.

W74-00292

#### WATER RESOURCES SUMMARY, ISLAND OF HAWAII,

Geological Survey, Honolulu, Hawaii.

For primary bibliographic entry see Field 02E.

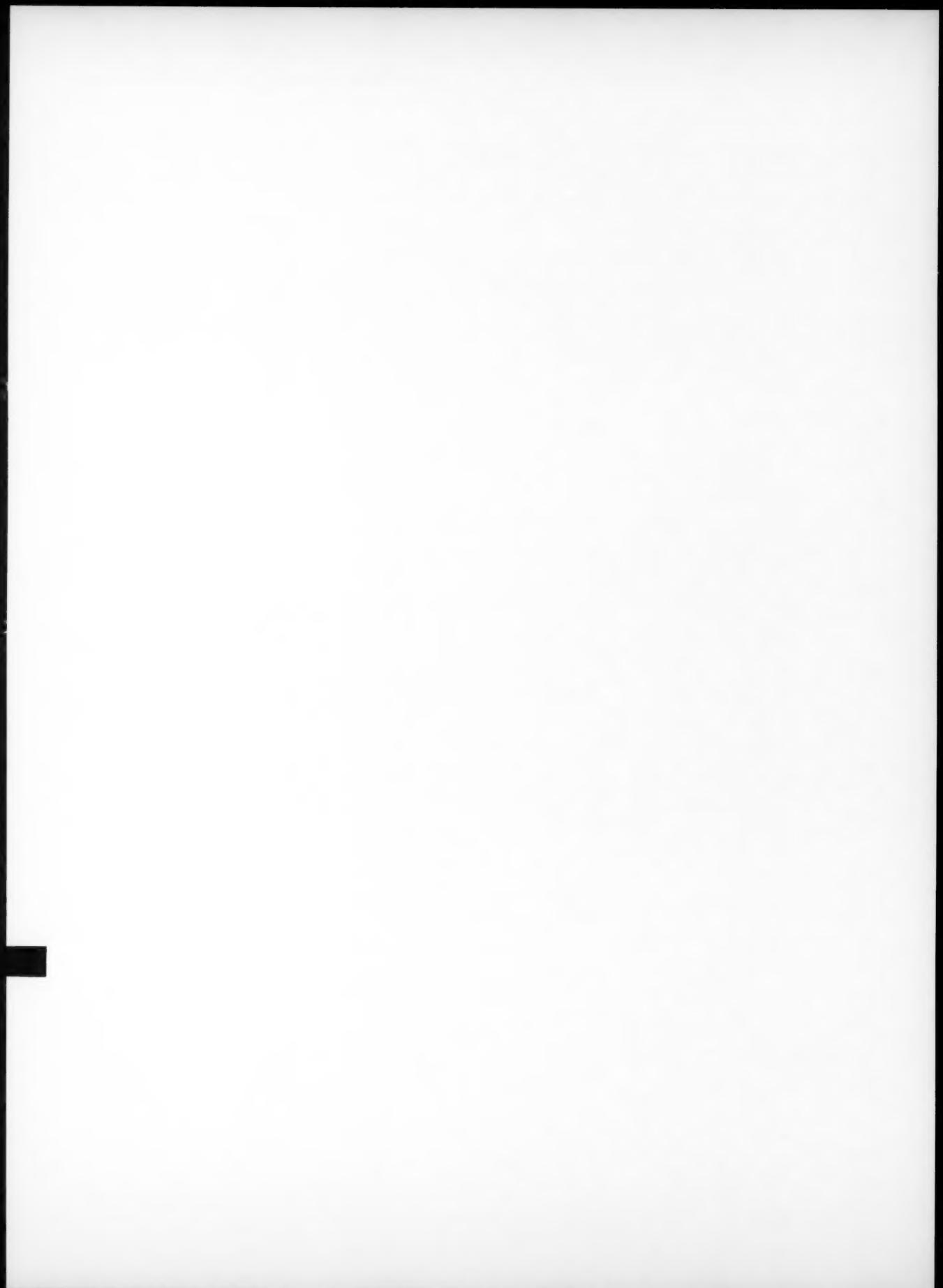
W74-00355

#### NITROGEN COMPOUNDS IN NATURAL WATER-A REVIEW,

Geological Survey, Menlo Park, Calif.

For primary bibliographic entry see Field 05B.

W74-00402



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Gas Chromatographic Determination of Aliphatic Amines and Quantitative Analysis of Small Amounts of Dimethylamine in Wastewater, W74-00077 5A

A Study of the Variation with pH of the Solubility and Stability of Some Metal Ions at Low Concentrations in Aqueous Solution. Part II, W74-00261 5A

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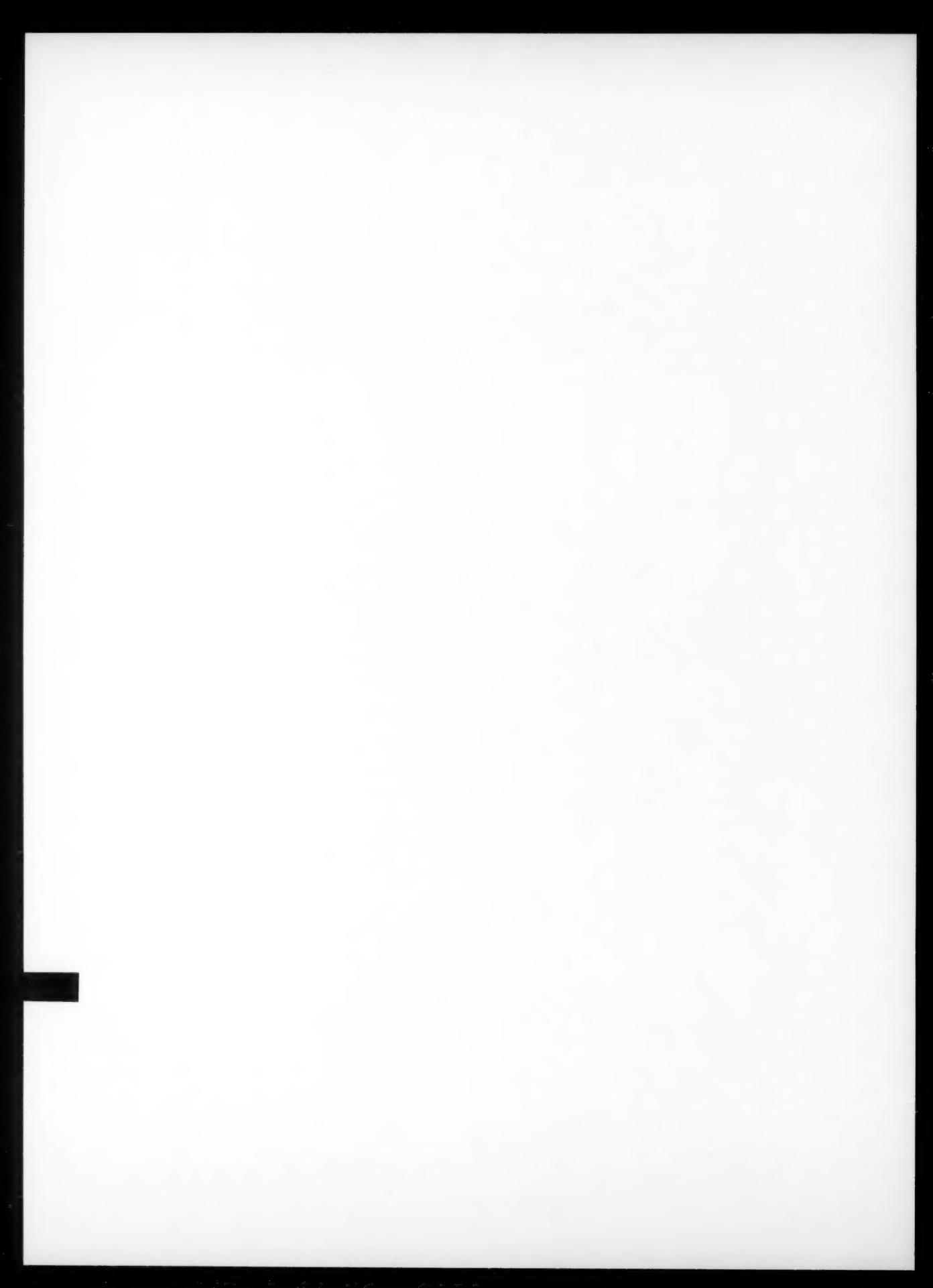
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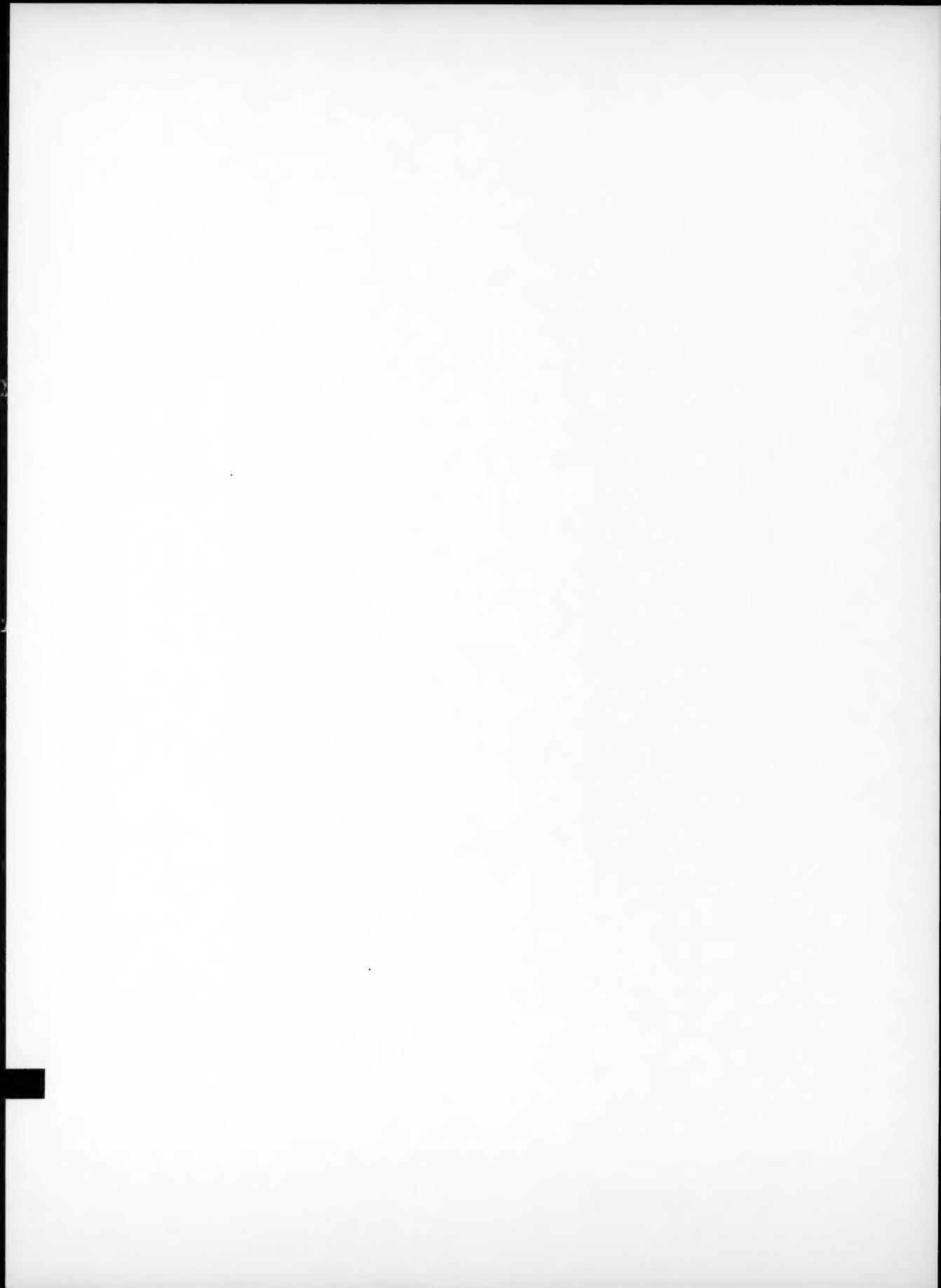
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## **CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE**

- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

### **Supported by the Environmental Protection Agency in cooperation with WRSIC**

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.
- Water treatment plant waste pollution control at American Water Works Association.
- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.

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